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REGULATIONS

OF THE

GEOLOGICAL SOCIETY OF DUBLIN.

I. OBJECTS.

THE Geological Society of Dublin is instituted for the purpose of investigating the mineral structure of the earth, and more particularly of Ireland.

II. CONSTITUTION.

1. The Society consists of Ordinary Members, Honorary Members, Corresponding Members, and Associate Members.
2. The Officers shall be chosen from among the Ordinary Members; and shall consist of a President, five Vice-Presidents, two Secretaries, and two Treasurers.
3. These, with fifteen other Ordinary Members, shall constitute the Council.
4. The Officers and other Members of the Council for each year shall be elected at the Annual General Meeting of the Society, in February.
5. In case any Officer or Member of the Council resigns, or dies, the Council may, if they think necessary, appoint some one to supply his place for the remainder of the year.

III. ADMISSION OF MEMBERS.

1. Gentlemen are admitted as Ordinary Members by vote of the Society, on being duly proposed and seconded.

2. The sum to be paid by each Member on admission, including his first year's subscription, shall be, at his option, £2, or £5.

3. If an admission fee of £2 be paid, the annual subscription is £1; and if an admission fee of £5 be paid, the annual subscription is 10s. In each case the subscription becomes due on 1st January, and shall be paid in advance.

4. Any annual Member who shall not pay such subscription within two calendar months after the 1st of January, or within such further time as the Council shall allow, shall cease to be a Member.

5. Any Member may compound for his Annual Subscription, by paying to the Treasurers the sum of £10.

6. Any Member who shall have paid an admission fee of £5 shall be at liberty, at any time, to compound for his annual subscription by payment of a further sum of £5.

7. Any person not residing for more than 63 days in each year within twenty miles of Dublin, shall be a Member for life, or until he comes to reside within the above distance, on paying to the Treasurers the sum of £5.

8. Any non-resident life Member who shall reside within twenty miles of Dublin for more than 63 days in any one year, shall cease to be a Member, unless he shall either pay an additional composition of £5, or shall pay a subscription of 10s. for each year in which he shall so reside for more than 63 days.

9. Members leaving the United Kingdom, and residing abroad, may within one year after their return resume their privileges, on payment of the current year's subscription, provided they were not in arrear at the time of their departure.

10. Distinguished persons residing out of Ireland may be elected Honorary Members of the Society, without annual or other payment, by a vote of the Society at any of its ordinary meetings, on the previous recommendation of the Council.

11. Corresponding Members may be elected by the Society at large on the recommendation of Council. They shall not be liable to any subscription while they continue absent from the country

12. Undergraduates of the University may be elected Associate Members, on being proposed and seconded in the usual manner. Such election shall only hold good for one year. Associates shall pay 5s, for each year they shall continue Associates, but will be credited with these payments, as against their admission fee, if they should afterwards become Ordinary Members.

13. It shall be deemed sufficient service of any notice concerning the business of the Society, to put it into the Post Office, directed to the address of each Member, entered in the books of the Society.

IV. OFFICERS.

President.

1. The same person shall not be President for more than five years in succession.

2. The President shall be Chairman of the Council, and of all meetings of the Society, when present.

Vice-Presidents.

1. Two, at least, of the Vice-Presidents shall go out at each election.

2. The Vice-Presidents shall in rotation, or otherwise, as they may agree amongst themselves, supply the place of the President, when he is absent.

Secretaries.

It shall be the duty of the Secretaries—

1. To attend the meetings of the Society and of the Council, and to see that minutes of the proceedings at each meeting are entered in a book to be kept for that purpose;

2. At each meeting, to read aloud the minutes of the preceding meeting;

3. At the ordinary meetings, to announce the presents and donations made to the Society since their last meeting, and to read

aloud such original or other letters and papers as the Council shall direct;

4. To conduct the correspondence of the Society;

5. To edit any publications of the Society;

6, To prepare a report of the proceedings of the Society during each year, to be read at the Annual General Meeting,

Treasurers.

It shall be the duty of the Treasurers—

1. To collect and receive for the Society all donations and subscriptions, and enter them in a book;

2. To furnish an account to the Society, at the Annual General Meeting, of the receipts and expenditure of the preceding year;

3. To report the state of the accounts, when called upon by the Council.

4. No money shall be paid by the Treasurers, except upon the order of the Council, signed by the Chairman, at a meeting at which at least five Members have been present.

V. COUNCIL.

1. Three Members, at least, of the Council must go out at each Election.

2. Five Members, including the Chairman, shall be a quorum.

3. The Council shall meet on the first and third Wednesday of each month. One of the Secretaries, with any two other Members of Council, shall have the power of convening a Meeting of Council at any time.

4. The Chair of the Council shall be taken in the same manner as that of the Ordinary Meetings.

5. A Member wishing that any of the Regulations of the Society should be altered or added to, must, in the first instance, submit the proposed alterations or addition in writing to the Council. If they approve of it, he may submit it to the Society for discussion at each of the two next meetings. If it is disapproved of by the Council, he may then submit it to the Society at the

Meeting of April or November, provided it is signed by himself and at least ten other Members. On being moved by him or any of these, it may be discussed at each of the two next Meetings. It may in either case be put to the vote at the last of such Meetings, but not sooner; and if approved of by such vote, it shall form part of the laws of the Society, but not otherwise.

VI.

It shall be the duty of the Council—

1. To superintend all the affairs of the Society, and to arrange the times and terms of admission of Visitors to the Library.

2. To arrange the business to be brought forward at the Ordinary Meetings, and at the Annual General Meetings.

3. To select from the Papers and Letters communicated to the Society those which appear to them of sufficient interest to be read to the Society, or to be published.

4. To make regulations as to the manner and cost of Publication and Illustration.

5. To carry into effect, as far as in their power, the various regulations of the Society.

6. To recommend to the Society the persons whom they think fit to be the Officers and Council for each ensuing year.

7. To appoint Salaried Officers, Clerks, or Servants of the Society.

8. The Council may exchange, or otherwise dispose of, duplicate books, maps, or specimens belonging to the Society, as they may deem advantageous to the Society.

All the property of the Society to be vested in the Council for the time being, who shall take care to keep accurate inventories and catalogues thereof, which they shall deliver to the succeeding Council, with the property mentioned therein.

9. The Council may authorise the lending of books, maps, drawings, and specimens, to any of the Members, under such regulations and conditions as they may think expedient.

10. All questions at the Meetings of the Council to be decided by a majority of votes, the Chairman having a casting vote, in addition to his ordinary vote.

VI. MEETINGS.

Ordinary Meetings.

I. The Society shall meet on the second Wednesday in each month, from November to June, inclusive, and on such other days as the Council may appoint.

II. At the Ordinary Meetings the order of business shall be as follows—

1. The Minutes of the preceding Meeting shall be read aloud by the Secretary, and be submitted to the Meeting for confirmation.
2. The Donations made to the Society shall be announced and exhibited.
3. New Members shall be proposed and balloted for.
4. Geological communications shall be announced and read.
5. The Members present shall then be invited by the Chairman to deliver aloud from their places their opinions on the communications which have been read, and on the specimens and drawings which have been exhibited at that Meeting.
6. When the other business has ended, the Society shall proceed to consider any measures which may be regularly brought forward.

III. The President, or in his absence one of the Vice-Presidents or Treasurers, shall be Chairman of the Meeting; and if these shall be absent, the Members present shall appoint some other Member of the Council to preside.

IV. All the questions shall be decided by the majority of votes.

V. Where the votes are equal, the Chairman shall have a casting vote, but he shall not have a previous vote as a Member.

VI. Any Ordinary Member shall have the privilege of introducing a stranger to the Ordinary or Annual General Meeting, subject to such regulations as the Council may from time to time think advisable.

ANNUAL GENERAL MEETING.

1. The Annual General Meeting of the Society shall be held

on the second Wednesday in February in each year, for the purpose of electing the Council and Officers for the ensuing year, and hearing the annual report of the Council to the Society.

2. A printed Balloting List shall be prepared before the day of the Annual Meeting, containing the names of such persons as the Council shall recommend to be elected Council and Officers for the ensuing year.

3. The Secretaries shall deliver one of such lists to each Member who wishes to ballot on the day of the Meeting.

4. The Chair to be taken at half-past eight o'Clock P. M.

5. A Balloting glass shall be then placed on the table, and remain there for one hour, when the ballot shall close.

6. A Member wishing to remove any person from the list may strike out his name, and write in its place the name of the person whom he wishes to be elected.

7. The list shall be thrown into the glass by each Member who votes.

8. The Chairman shall appoint two Scrutineers, whose duty it shall be to superintend the ballot, and see that none but Members ballot, that no Member ballots more than once, or puts more than one list into the Glass.

9. At the expiration of the above hour, when the ballot has closed, one of the Scrutineers shall read the several lists aloud, whilst the other shall put a mark against each name as often as it is repeated.

10. The two Scrutineers shall then count the number of marks affixed to each name; and those who have the greatest number of marks shall be elected as they stand in the list, provided that amongst these there be at least three new Members of Council, and two new Vice-Presidents.

11. But if amongst these there be not at least three new Members of Council, and two new Vice-Presidents, those proposed Members of Council or Vice-Presidents who have the least number of marks respectively shall be rejected, until two Vice-Presidents and three Members of Council are excluded; and their places shall be supplied by those who have the next greatest number of marks, respectively.

12. If two or more names have an equal number of marks, the order of preference shall be decided by lot.

13. When the Scrutineers have reported those who are elected, the Chairman shall declare the names to the Meeting.

14. Before the commencement of the ballot, the Chairman shall read aloud the preceding regulations.

15. While the ballot is in progress, the Annual Report shall be read aloud by one of the Secretaries; and any Member may propose any question to the Secretaries respecting the matters contained in such Report, and make such observations upon the affairs of the Society as he may think fit.

VII. PAPERS.

1. All Papers sent to the Society are to be considered as its property forthwith.

2. No Paper shall be read at the Meetings of the Society until the Secretaries shall have apprised the Author of this regulation, in case he shall not be a member of the Society.

3. If any Author shall request that his Paper may not be published in the Journal of the Society, or otherwise, such request shall be complied with.

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I.—On the Occurrence of Nickeliferous Magnetic Pyrites from Tiernakill, near Maum, County of Galway. By the Rev. Samuel Haughton, F.R.S., President.

[Read June 13, 1860.]

The royalties of the estate of the Provost of Trinity College in the county of Galway having been leased to Mr. Hodson, of well-known mining celebrity in the county of Wicklow, this gentleman has proceeded to develop the resources of this part of the county of Galway with his accustomed skill and success. Six lodes have already rewarded his enterprise, viz.:—

1. Main lode: 20 ft. wide, containing sulphur and a little copper ore.
2. North lode: 12 ft. wide.
3. Cross lode: in places seen 20 ft. wide, containing sulphur, copper, and particles of lead ore.
4. East and west lode: 30 ft. wide, containing a little sulphur ore.
5. South lode: 20 ft. wide, with a most beautiful appearance of sulphur and copper ore.
6. Iron lode: seen at surface 30 fms. wide.

The sulphur ore from these lodes was carefully examined by Mr. M'Dowell and myself, in October last and in May, with the following results:—

First Analysis.

Chlorite,	0·25
Iron,	60·41
Copper,	0·21
Nickel,	0·07
Sulphur (diff.),	39·06
	100·00

Second Analysis.

Chlorite and Quartz, ...	11·85
Iron, ...	52·44
Sulphur, ...	35·70
	99·99

From these analyses, it is evident that the ore is magnetic pyrites, containing traces, though unquestionably genuine, of copper and nickel; which latter valuable metal, it is to be hoped, will occur in greater quantity as the mining operations descend. From the two analyses, it appears that the proportion of atoms of iron and sulphur are:—

	1st Analysis.		2nd Analysis.	
Iron, ...	2·16	7	1·87	6
Sulphur, ...	2·44	8	2·23	7

These are proportions commonly recorded for this mineral. I believe myself that the mineral is probably a protosulphuret of iron, with a slight mechanical admixture of iron pyrites.

The lode containing the magnetic pyrites bears N. 76° W. by compass, and, if prolonged, would pass probably into the townland of Barrowgarriff, the minerals from which have been reported on by Dr. Apjohn.

The true bearing of this lode is W. 12° S. The veinstone is quartz and chlorite, so well known to Cornish miners as "Peach."

Another of the lodes, known as the Iron Lode, bears N. 65° E. by compass, or N. 39° E. (true), and contains large masses of red massive garnet, similar to that found in lodes at Botallack, in West Cornwall, and brown iron ore, the veinstone being, as before, quartz and chlorite; it is between 20 and 30 yds. wide.

II.—On Two Associated Minerals from Ross Hill, near Maum, Co. Galway. By James Apjohn, M. D., Professor of Chemistry and Mineralogy in the University of Dublin.

[Read December 12, 1860.]

In January, 1859, I received from Alexander Dickson, Esq., agent to Lord Leitrim, a box of rocks and minerals, and was requested by him to make such experiments upon them as would enable me to report upon the commercial value of each, and the mineral character of the district in which they were found. The specimens were collected by Mr. Dickson upon the townlands of Cleggan and Carrowgariffe, part of the Rosshill estate, situate in the mountain district of Connemara, lying between Lough Mask and Lough Corrib. The metallic minerals were few in number, and of a common kind, consisting of galena, the ordinary ore of lead, and of two compounds of sulphur and iron. One of these, which occurred in minute crystals, disseminated through quartz, was the well-

known iron pyrites; the other was massive, slightly magnetic, and had adhering to, and dispersed through it, a green substance, resembling chlorite, and which, upon a qualitative examination, was found to be a silicate of the protoxide of iron.

Of the earthy minerals, there was but one having any claim to novelty, and it is to this that I venture to solicit the attention of this Society for a few moments.

This substance, which Mr. Dickson informed me was very abundant on Cleggan, had a curved, foliated structure, the laminæ of which it was composed not being parallel in masses of any size, but intersecting at various angles. Its colour was white, with occasionally a tinge of yellowish-green; its lustre pearly, and in very thin laminæ it was subtranslucent; its hardness was somewhat over 2, or a little higher than gypsum.

Before the blow-pipe it was nearly infusible, and it had the specific gravity of 2·802. Submitted to a careful analysis, it was found to have the following composition:—

Silex,	46·42	1·02	4
Alumina,	37·92	0·74	3
Peroxide of iron,	0·46		
Lime,	0·67	0·26	1
Magnesia,	0·17		
Potash,	9·63		
Soda,	1·54		
Water,	4·40	0·48	2
	101·21		

Upon discussing these results in the usual manner, they are found to conduct to the empirical formula

$$4SiO_3 + 3R_2O_3 + RO + 2HO,$$

R_2O_3 representing the alumina and peroxide of iron, and RO the combined amount of the alkalies and alkaline earths. From this it is easy to deduce the rational formula

$$RO, SiO_3 + 3(R_2O_3, SiO_3) + 2HO;$$

or, should we wish to avoid any hypothesis as to the manner in which the proximate constituents are arranged, we can write it

$$(\tfrac{1}{10}3RO + \tfrac{9}{10}R_2O_3)\,\tfrac{6}{5}SiO_3.$$

This latter method of representing in symbols the constitution of a mineral is becoming popular with mineralogists, as it takes cognizance of a fact, now pretty well established, viz., that protoxides and sesquioxides may replace each other; and also exhibits, by means of the coefficient attached to the silicic acid, the ratio between the amount of oxygen in the latter and in the basic oxides.

When I had completed this analysis, I was under the impression that I had fallen on a new and interesting mineral, having some general resemblance to talc, but differing from it in important particulars, being a little harder, and having a totally different composition,—containing,

for example, but a mere trace of magnesia, the sole basic constituent of true talc, but, instead thereof, about 38 per cent. of alumina, and over 11 per cent. of mixed soda and potash. Before, however, announcing it as new, it became necessary to look into the books; and, having done so, I find mention made of several minerals which have some resemblance to that under consideration. A few of these minerals have been noticed by Thomson and Dana; but the most complete list of them occurs in the recent interesting volume, by Gregg and Lettsom, on the Mineralogy of Great Britain and Ireland. The subjoined Table includes these different minerals, and, in addition, the Damourite of Delesse, a mineral found in Brittany, associated with Kyanite. The name of each mineral, its locality, and the name of the chemist by whom its analysis was made, is also given:—

TABLE I.

	Talcite, Wicklow (Tennant.)	Talcite, Wicklow (Short).	Gilbertite, Cornwall (Lehunt).	Gilbertite, Cornwall (Thomson).	Talcite, Three-Rock Mountain, Co. Dublin. (Haughton.)	Margarodite, St. Etienne (Delesse).	Margarodite, Connecticut (Brush).	Damourite, Brittany (Delesse).
Silex, ...	44·55	46·00	45·15	47·79	43·47	46·23	46·50	45·22
Alumina, . . .	33·80	35·20	40·11	32·61	31·42	33·08	33·91	37·87
Peroxide of Iron,	. .	. .	. .	. .	4·79	3·48	2·69	. .
Protoxide of Iron,	7·70	2·88	2·43	5·17	. .	. .	·82	trace
Protoxide of Manganese, ...	2·25	3·94	. .	. .	. .	. .	·31	trace
Lime, ...	1·30	9·61	4·17	. .	1·38	. .	. .	. .
Magnesia, . . .	3·30	. .	1·90	1·60	1·13	2·10	·90	. .
Potash, ...	. .	. .	. .	. .	10·71	8·87	7·32	11·20
Soda, ...	. .	. .	. .	9·23	1·44	1·45	2·70	. .
Water, ...	6·25	2·00	4·25	4·00	5·43	4·12	4·63	5·25
	99·15	99·63	98·01	100·40	99·77	99·33	99·78	99 54

Before comparing these minerals with each other, and with that from Connemara, it was desirable to calculate the empirical formula of each. This has been done, and the results are here subjoined:—

TABLE II.

Talcite, Wicklow (Tennant), . .	$6SiO_3 + 4R_2O_3 + 3RO + 4HO$.
Talcite, Wicklow (Short), . . .	$5SiO_3 + 3R_2O_3 + 2RO + HO$.
Gilbertite, Cornwall (Lehunt), . .	$6SiO_3 + 5R_2O_3 + 2RO + 3HO$.
Gilbertite, Cornwall (Thomson), .	$10SiO_3 + 6R_2O_3 + 5RO + 4HO$.
Speckled Mica, Three-Rock Mountain (Haughton), ...	$3SiO_3 + 2R_2O_3 + RO + 2HO$.
Margarodite, St. Etienne (Delesse),	$3SiO_3 + 2R_2O_3 + RO + 1{\cdot}3HO$.
Margarodite, Connecticut (Brush and Smith), ...	$3SiO_3 + 2R_2O_3 + RO + 1{\cdot}6HO$.
Damourite, Brittany (Delesse), .	$4SiO_3 + 3R_2O_3 + RO + 2HO$.
Mineral from Connemara (Apjohn),	$4SiO_3 + 3R_2O_3 + RO + 2HO$.

The preceding Table may be also thus written:—

TABLE III.

Talcite (Tennant), ...	$(\frac{1}{5}3\,RO + \frac{4}{5}R_2O_3)\,\frac{6}{5}\,SiO_3 + 4HO.$
Talcite (Short), ...	$(\frac{2}{11}3RO + \frac{9}{11}R_2O_3)\,\frac{15}{11}SiO_3 + HO.$
Gilbertite (Lehunt), ...	$(\frac{2}{17}3RO + \frac{15}{17}R_2O_3)\,\frac{18}{17}SiO_3 + 3HO.$
Gilbertite (Thomson), ...	$(\frac{5}{23}3RO + \frac{18}{23}R_2O_3)\,\frac{30}{23}SiO_3 + 4HO.$
Speckled Mica (Haughton), . . .	$(\frac{1}{7}\,3\,RO + \frac{6}{7}R_2O_3)\,\frac{9}{7}\,SiO_3 + 1{\cdot}3HO.$
Margarodite (Delesse), ...	Do. do.
Margarodite (Smith and Brush), . .	Do. do.
Cleggan Mineral (Apjohn), . . .	$(\frac{1}{10}3RO + \frac{9}{10}R_2O_3)\,\frac{6}{5}SiO_3 + 2HO.$
Damourite (Delesse), ...	Do. do.

Of these different minerals, the only one which has exactly the same composition with mine is the Damourite of Delesse. The analysis is given in Dufresnoy's Mineralogy; and upon examining it, I find it yields precisely the same formula as that at which I have arrived for the mineral from Cleggan. I may add that it has the same specific gravity (2·792), the same degree of hardness, the same colour and lustre, and behaves before the blow-pipe in a similar manner. In fact, I cannot entertain any doubt that they are both specimens of the same species.

The Wicklow Talcites, analysed by Short and Tennant, are quite distinct from my mineral, their formulæ being different, and the fixed alkalies being absent from them. The same may be said of the Cornish Gilbertites; only one of these (that analysed by Thomson) includes an alkali, and this is altogether soda. The Margarodites of Haughton, Delesse, and Brush, appear to be identical minerals; but, although including the alkalies in considerable quantity, their formulæ are so different from that of the Cleggan mineral, and from Damourite, that the two latter cannot be confounded with them. Their physical characters also are, I believe, materially different from Damourite. This is certainly true of the mineral analysed by our Chairman,—a specimen of the speckled mica of the Three-Rock Mountain,—but which Gregg and Lettsom have most unjustifiably denominated *Talcite.*

And here it will be proper to observe, that our able and indefatigable President, in his valuable Notes on Irish Mines, has given the analysis of a pale-green steatitic substance, which he describes as often occurring in the mineral lodes of Wicklow, and the granite which they traverse. This mineral might certainly be called a Talcite, from its resemblance to some varieties of Talc. It is also similar in appearance to Damourite; but differs from it somewhat in composition,—not, however, to such a degree as to render it impossible that they should be the same mineral. The close analogy between the two minerals will be best seen by writing the formula of each upon the hypothesis which assumes that a protoxide and a sesquioxide can replace each other in quantities which include the same amount of oxygen. Written on this plan, the pale-green steatitic mineral of Professor Haughton, and the mineral from Connemara, will be represented as follows:—

Mineral from Connemara, . . $(\frac{1}{10}3RO + \frac{9}{10}R_2O_3)\,\frac{6}{5}SiO_3$.
Pale-green steatitic mineral, . $(\frac{1}{10}3RO + \frac{9}{10}R_2O_3)\,\frac{3}{2}SiO_3$.

The discrepancy between these formulæ is certainly small, and I incline to the opinion that the minerals to which they refer will ultimately prove to be the same; or, in other words, that Professor Haughton has preceded me in detecting the Damourite in Ireland. The locality of Cleggah, in Connemara, will still be distinguished by containing this mineral in large masses, spread over an extensive district, and not merely as a thin, superficial coating on granitic rocks, the form in which it has been found in Wicklow.

The Damourite of Delesse was, as has been already mentioned, found associated with numerous crystals of Kyanite. I have now to state that the Damourite of Connemara has imbedded in it numerous prismatic nodules, more or less rounded, of a mineral having the same composition as Kyanite, and well known under the name of Andalusite. In thin splinters, it has something of a flesh-red colour; is subtranslucent, and infusible before the blow-pipe. The crystalline form could seldom be deduced from an examination of the nodules; but in one or two specimens the outline of the right rhombic prism could be traced without difficulty. The specific gravity, taken with great care, was 2·9952, a number which may be considered as identical with 3, the latter being that usually given in systematic works as representing the density of Andalusite. This coincidence in physical characters is so complete, that it seemed almost superfluous to submit the imbedded nodules to analysis. For fear, however, of any mistake, this precaution was taken; and it was found that the experimental results corresponded sufficiently well with the formula $3Al_2O_3$, $2SiO_3$, which is known to represent the composition of most varieties of Andalusite. Nothing more, I may observe, than an approximation to the truth could be expected; for the nodules were so coated on the surface, and penetrated throughout with flakes of the Damourite, that it was found impossible to obtain for experimental purposes specimens of perfect purity.

III.—Letter from Mr. Thomas Stanley on the Faults sometimes found in the Drift Gravel of Ireland.

[Read June 13, 1860.]

Tullamore, June 8, 1860.

Sir,—I beg to inform you that I had been occasionally upon the line of rail which runs from this town to Athlone during the time of its construction; and, while I amused myself with the gossip of holiday folks, who used to be loitering about, and all agape at the gashes in the green-hill sides, and other objects of wonder, I was not inattentive to the geological features which were presented; and drift phenomena—an old hobby of mine—could not possibly be forgotten. All the cuttings of the way were in drift deposits. Four great esker ridges were opened; one

of these, which runs beside Clara, when in section, exhibited sands and gravels stratified in a very beautiful manner. While I was testing the stratification of this esker, I was greatly surprised to find the whole mass broken through with faults. The strata from the surface to the lowest sinkings were cut by perpendicular fractures; some of which were close by each other, and some were a few yards apart; and the elevations and depressions varied from two or three inches to as many feet. The direction of the break was parallel to the range of the hill. Being aware that there was another sinking in a similar pile near the Terminus in Athlone, I took the earliest opportunity to see it. I found the disturbance greater here than at Clara, the breaks being closer to each other, and more complicated. And here, while resting amongst these sands, at the end of a toilsome journey, the reward and chief object of which were lying open like a great book before me, I was not a little amused with the geology of three of Athlone's burghers. Peacock, calling to Peacock, —while I escaped being run over by them,—Why is it that these sands are always found without stones? And Peacock responding, Why, Peacock, it is because no stones are ever found in them. The disturbance evidently increases with the distance from Tullamore. There are not many breaks in strata in the neighbourhood of this town. This is probably part of an extensive disturbance which is known to have occurred in the drift. In some papers, which were addressed to your Society, I noticed the almost demonstrable fact of an ebb interval of some centuries occurring between two drifts, or overflow periods; and it is probable that our disturbance took place in this interval. Though the faults are continued upwards to the surface, they do not break the smooth outline of hill; and patches which have not known cultivation should retain a ridge and furrow, if there had not been a levelling agent. It is certain that overflows succeeded the disturbance, which removed the inequalities I noticed in clay deposits overlying the faults in some instances.

I am your obedient servant,

THOMAS STANLEY.

Professor Haughton, Trinity College, Dublin.

IV.—ON THE WOLFHILL AND MODUBEAGH COAL-FIELDS, QUEEN'S COUNTY. BY GEO. M'DOWELL, Fellow of Trinity College, Dublin. [Plate I.]

[Read June 13, 1860.]

THE Wolfhill, Mullaghmore, and Modubeagh Collieries lie in the north-eastern part of the Leinster Coal-field, a few miles beyond Ballylinan, on the road from Athy to Castlecomer. They have been hitherto worked as separate mines, and in a most unminerlike and unprofitable way.

So long ago as 1814, Sir Richard Griffith, in his Report on this district, says of the Wolfhill Colliery, that it is unwatered by a level which has been driven into the hill at a considerable expense; but the field of coal commanded by it is trifling; while the Ballylehane coal has only been worked where it was shallow; and the deep part remains untouched. As the coal-bed which occurs in these fields is the same,

being the first slate-coal of Sir R. Griffith, and as there is nothing to prevent the joint working of them all on a uniform plan, I thought it might be interesting to those members of the Geological Society who take an interest in mining matters to have a short account laid before them of these collieries, and of the plan on which it is now proposed to work them on a joint system.

The coal-bed which occurs in them has been traced by Sir R. Griffith on the east side of the Leinster Coal-field from Wolfhill; on the north, by Ballylehane, Corgee, Poulitean, and Rushes, to Courlean and Clogrenan on the south. The eastern outcrop of this bed of coal, in the part of the Leinster Field under consideration, is shown on the map by the pits at Mullaghmore, Trial Pit, Hanlon's Pit, and Tully's Pit; and the coal is probably separated from the Glen Colliery, to the south, by a series of cross faults or hitches running east and west. The Wolfhill Colliery is separated from that of Mullaghmore, Modubeagh, and Ballylehane by a north and south fault, with a downthrow to the east of probably 90 or 100 yards. This fault divides the whole coal-field into an eastern and western division, which will be worked by distinct pits. The dip in both is to the south-west, but less in Wolfhill than in Modubeagh, being about 1 in 13 in Wolfhill, and as much as 1 in 7 in Modubeagh.

The unwrought portion of the coal in the two fields is shown on the map by the dotted area, which it is now intended to work by a systematic course of mining operations devoted to the extraction of the entire coal of both the eastern and western divisions of the district.

The good coal of the seam is from eighteen to twenty inches thick. It burns easily, and is very free from sulphur. It rests upon a bed of fire-clay of good quality, varying from two to three feet thick. This contains Stigmariæ, converted into iron pyrites, but still retaining on their surface the characteristic pittings of the tree of which they formed the root. The fire-clay, no doubt, was the soil in which the coal-plants grew. The roof of the coal is dark fissile shale, and abounds with various forms of Lepidodendrons.

The coal-field which I have thus brought before the notice of the Society, in a country abounding in coal, would, probably, be of little value from the thinness of the seam; but in a country like Ireland, where fuel is scarce, and, consequently, of high price, it is well worth while to direct attention to mineral resources, which, although not great, may, nevertheless, be made to yield a profitable return to capital expended with skill and economy.

V.—Geological Description of the District extending from Dungarvan to Annestown, County of Waterford. By W. B. Brownrigg, S. T. C. D., and Theodore Cooke, C. E. [Plate II.]

[Read May 9, 1860.]

The section which we have the pleasure of laying before the Society, commences on the crest of the hills of which Helvick Head is the termi-

nation, and which separates the district around Dungarvan from the Vale of the Blackwater.

This section runs nearly east and west, its total length being twenty miles; but the line over which our observations extended, principally along the coast, is seventy miles.

Our examination ranges over a very barren kind of country, which is formed of a wide Carboniferous basin, reclining in and flanked on both sides by a similar basin of sandstone, succeeded by Silurian and alternating Igneous rocks, which extend eastward as far as Tramore, the ground rising gradually from Dungarvan, and the coast being very bold, rocky, and storm-shattered.

We do not know if the idea is original; but we have represented the geological features of the coast by supposing two planes at right angles to each other,—one vertical through line of section, while the other is horizontal, and forms a continuation of the sea-level; and then, ideally, removing the mass of earth so cut away, thus exposing to one view the dip, strike, and planes of bedding, with the undulations of the hills, and contour of the coast (*vide* Plate II.). On the representation of this compound section, there is an interval left blank along the line of intersection of the planes, on which we have recorded our principal observations of strike and *corrected* dip, which will appear by simply laying out the section on the level.

Commencing with the Old Red Sandstone, we searched particularly for any traces of plants, with reference to Sir R. Griffith's Carboniferous base line; but they do not seem to occur in this locality. The stratification is formed of fine-grained purplish Sandstone shale, alternating with micaceous sandstone, often containing ferruginous amygdaloidal cavities. The sandstone is contorted at this point, forming a distinct anticlinal axis.

The shales and sandstones become lighter in colour as we ascend the series towards the Yellow Sandstone, which latter is often much weathered, and showing secondary lines of deposition.

There is nothing worth recording in the Lower Limestone Shale which occurs next, and we pass to the more immediate neighbourhood of Dungarvan.

Dungarvan has been lately brought into geological notice by its limestone caves, which are, in many respects, similar to those of Mitchelstown and Mapstown, having their representatives in the mountain Limestone of Derbyshire, Devonshire, and Adelsberg.

To illustrate the extent to which some of the caves of this formation in the South of Ireland stretch, we may mention that, at Nicholastown, a cavern, similar to that at Dungarvan, occurs, *two miles* in length. In these caves at Dungarvan, great quantities of bones were lately found by Mr. E. Brennan,—consisting, according to Dr. Carte's identification, of those of the mammoth, bear, rein-deer, horse, hare, &c. Mr. Brennan's paper on the subject was published last year in the Journal of the Royal Dublin Society Dr. Carte has kindly permitted us to see these remains, now deposited in the Museum of the Royal Dublin Society,

and states that he has not been able to observe traces of gnawing upon any of them, which seems to support the view of the absence of predatory agency as a means of transport, in this instance at least. We were not fortunate enough, during the short period we spent in the locality, to find any similar remains; but we observed some of the usual fossils of the Lower Carboniferous Limestone, both here and further on along the coast at Bayview, of which the following were the principal:—

Euomphalus pentangulatus.
Producta Scotica.
Lima levigata.
Cardiomorpha oblonga.

Actinocrinus triacontadactylus.
Cyathocrinus pinnatus.
Cyathophyllum crenulare.
Lithodendron.
Amplexus coralloides.
Fenestella.

We also observed a nodular structure frequently occurring throughout this limestone; and the texture of the stalactites, dripping from the roofs of these caves, is remarkably clear, hard, and crystalline.

At Shandon and Bayview, the limestone is of a very light colour, and produces tolerably good lime, though not nearly equal to that of Carlow, Kildare, and other parts of Leinster.

At Bayview, we found conglomerate formed of limestone pebbles, of considerable size; the rock also varying much in hardness and texture. We obtained several specimens of remarkably contorted encrinites: from the appearances observable in some of them, they seem as if motion had occurred with unequal sliding parallel to the planes of bedding, causing the once circular and perpendicular, but now elliptical, sections of the encrinite stems to lie in planes inclined to those of bedding at acute angles.

It might be interesting to examine these examples in connexion with our President's rules for distortion of fossils, published in a former number of our Proceedings.

We again come on the Lower Limestone Shale at Ballynacourty, where the number of encrinites is positively infinite. The rock is simply one mass of encrinites, cemented together by soft shale.

We also found here specimens of the *Pleurorhynchus alæformis*, much compressed. Near Clonea Castle, at the junction of the limestone and shale, we noticed what seemed at first to be dark-coloured rocks, in a small stream which cuts its way to the sea through the fine sand which, to a small extent, covers this part of the coast; but, to our surprise, these turned out to be *turf*, principally formed of debris of pine and oak—forests of a former age; it was in the pine of this submerged turf-bog that Dr. Farran found the *Teredo Norvegica*, an account of which he published some few years since in the Journal of the Natural History Society of Dublin.

On passing Clonea, the shore is strewed with debris of sandstone and shale in boulders, with coarse gravel, those of sandstone conglomerate often very large; and the shale is here covered above the cliffs, with upwards of eighty feet of drift and clay. Presently, we again meet the red, purple, and yellow Sandstones; and at this point data exist for determining the whole thickness of the sandstones of the district,—it being, as it were, epitomized here in one compact wedge, which is interposed between the Carboniferous and Silurian series.

Close to Ballyvoyle Head, above the River Tay, we observed faint marks, similar to those in the Old Red Sandstone, before mentioned, which may have been plant-remains; but they were too indistinct to enable us to form a definite opinion as to the geological horizon in which they occur. It may be mentioned, that beds of sandstone shale and Yellow Sandstone here alternate, and are often of a micaceous character.

We next met rocks which, though apparently Igneous, presented appearances of stratification so decided, that they may possibly partake of Metamorphic character. Close to these, a dyke of greenstone penetrates the Silurian, which here, as well as throughout the whole section, presents a series of synclinal axes, owing, no doubt, to the agency of the uptruding greenstone.

Passing Stradbally at Blind Cove, we determined, by direct observation, the greenstone cliffs to rise perpendicularly to the height of 300 feet out of the sea; and in the Silurian slate following, we observed a considerable amount of chlorite.

Still proceeding eastward in the Silurian, we observed a wedge of compact Silurian, apparently let in so as to form faults on both sides in the face of the cliff, which had evidently been much exposed to disintegrating influences; a vein of the same formation, strangely twisted, of a lighter or whitish-blue colour, appears to have been subsequently introduced, from the fact of the planes of lamination occupying an oblique position.

In a direct line, and parallel to the coast, an elvan dyke here occurs, broken at intervals, containing copper, which, for the first time, is now met with. We also, in conjunction with the Silurian, found quartz and calcareous spar distinctly crystallized in one block. We may mention, in passing, that the greenstone rocks throughout the district have distinct planes, similar to those of bedding.

At Ballydowane Bay, curious conjunctions and faults occur between the Old Red Sandstone and surrounding greenstone, as will appear by reference to a sketch which we attach.

Between Rinnamoe Head and Bunmahon Head we found a large piece of rock containing galena. We merely mention the fact to call the attention of future geologists in that neighbourhood to the circumstance, as galena has not hitherto been found in the district, at least that we are aware of.

In this locality we obtained good specimens of greenstone porphyry, the crystals being of red felspar; as also specimens of siliceous felspathic

light-green porphyry. Nearer to Bonmahon, the Old Red Sandstone again occurs; and the peculiar appearance may be occasionally observed, for which Professor Haughton, in his late paper on Cyclostigmaceæ, has proposed the term tribolith; but this structure is much better developed in the Kiltorkan beds than in those of Waterford.

The devastation which the sea and land springs are making on this coast must be seen to be appreciated. We can easily conceive that, within a very short period (geologically speaking), Ireland stretched far south into the Atlantic Ocean; and that its Old Red Sandstone coast, now swept away, or only evidenced by detached masses, boulders, and shingle, along the shore, once extended, forming an unbroken range, from Helvick Head, in the county of Waterford, by Milford Haven, to the Red Sandstones of Herefordshire.

From Knockmahon, all along the cliffs, to Dunnabrattin Head, the devastating action of the sea is fast antiquating the most recently constructed maps of the coast line,—carrying away, from time to time, large masses of disjointed greenstone and Silurian rock, to mingle with the rolled and rounded debris of the Red Sandstone, which everywhere strew the coast.

We spent five hours, one day, very pleasantly, underground in the Tankardstown copper-mines, through the kindness of the manager, Captain Francis Bennet; and specimens of the various kinds of gangue, ore, and elvan, which occur in them, we have laid on the table for the inspection of the Society.

We obtained very fine specimens of malleable copper, but only near the surface; the sulphide appearing in depth as we descended. In one instance, in the Bonmahon mine, the lode is interrupted by a band of Red Sandstone; there also occur very distinct examples of reversed faults.

In conclusion, we would suggest, that the great disturbing influences observable all through the section described in the present communication, as shown by the numerous synclinal and anticlinal axes, considered in connexion with the distortions of the Carboniferous fossils and the dykes mentioned as occurring in the Silurian district, may have arisen from pressures along a fixed line of internal and probably igneous action running through Knockmahon, the Wicklow Mines, Isle of Man, Westmoreland, and Kirkcudbright, the active periods of which were successively recurring, some during the Silurian epoch, and coinciding with E. de Beaumont's second Palæozoic system of disturbances; another of those periods of activity may have been towards the latter end of the deposition of the Old Red Sandstone; while others, again, may have been during the Carboniferous period; and we think that the tribolithic appearance to which we before referred, may also tend to corroborate this theory, as being proof of sliding having taken place under circumstances of severe pressure affecting the mass of the Sandstone strata.

VI.—On some Additions to the Yellow Sandstone Flora of Donegal. By the Rev. Samuel Haughton, F. R. S., President.

[Read December 12, 1860.]

Some weeks ago, Mr. William Harte, Surveyor of the county of Donegal, having discovered some fossil plants at Darney, near Dunkineely, county of Donegal, forwarded them to me for examination. On inspection, I recognised several of them as old friends, and others illustrating new features in the structure of known fossil plants of the Yellow Sandstone Period; while one of them appeared to me so completely novel, as to warrant me in bringing it under the notice of this Society.

This fossil is evidently the cast of the mid-rib and lateral branches of a large leaf, and appears to be exogenous. Professor Harvey, however, considers it may be endogenous, and quotes, in illustration of this view, the leaves of the Aroïdeæ.

It bears so striking a resemblance to the *Dictyophyllum crassinervium* of Lindley, that I do not hesitate to place it in that genus, and to give it the name *Dictyophyllum Darniense,* from the Yellow Sandstone locality in which it was found.

The other plants found by Mr. Harte bear a striking resemblance to the *Lepidodendron Griffithii,* found at Kiltorcan by Dr. Carte, and described by A. Brongniart. I believe, however, that this species and the so-called Knorrias of the south of Ireland and Germany are identical with the plants which I have elsewhere referred to the genus Cyclostigma.

Another of the plants found by Mr. Harte is a Stigmaria, exhibiting the remarkable peculiarity of a central "core," or axis, which is itself marked with the leaf-scars, to which the term Knorria has been applied.

DESCRIPTION OF THE PLATES.

PLATE D.

Dictyophyllum Darniense.—Cast of the mid-rib and lateral nerves of large fossil leaf, showing, apparently, exogenous reticulation.

PLATE E.

Stigmaria.—Showing the lateral rootlets and Cyclostigmatic markings peculiar to the genus, with the minute dot in the centre of each, corresponding to the bundle of woody fibres; also exhibiting the central "core," with its Lepidodendriform, or Knorria-like markings.

PLATE F.

(*a*) Cast of a portion of the leaf or bark of an unknown fossil plant.
(*b*) *Cyclostigma* (*Lepidodendron*) *Griffithii* (A. Brongniart), showing the dichotomous branching and peculiar arrangement of the leaf scars.
(*c*) Another specimen of ditto.

VII.—A new Pyrognostic Arrangement of the simple Minerals hitherto found in Ireland. By Aquilla Smith, M.D., M.R.I.A.

[Read June 13, 1860.]

[The President stated that Dr. Aquilla Smith had entrusted to him his numerous notes on Irish Mineralogy, which in his (the President's) opinion were of the highest interest and value, both in a historical and in a scientific point of view. It was his intention to bring these notes from time to time before the Geological Society, and to add to them such contributions as his own knowledge of Irish minerals enabled him. As a commencement, he introduced to their notice the following tabular classification of Irish Minerals, founded altogether upon their pyrognostic characters. It was quite unnecessary for him to comment on Dr. Smith's known skill in the use of the blowpipe, which he regarded as the most valuable instrument in the possession of the mineralogist. He had himself, under Dr. A. Smith's instructions, attained to some skill in the use of this weapon, and felt much pleasure in bearing his testimony to the value and accuracy of the following classification.]

"The merit of mineralogy seems to me to consist in presenting such *criteria* as may enable us to distinguish minerals in the shortest, easiest, and surest manner."

Kirwan, 1784.

Class I.—FUSIBLE.

Order I.—Combustible.

Div. I.—Combustible *with* flame.

Div. II.—Combustible *without* flame.

Order II.—Incombustible.

Div. I.—Fuse into a slag or bead.*
- A. *With* exfoliation, intumescence, or effervescence.†
  - *a.* Bead colourless or white.
    - 1. Anhydrous.
    - 2. Hydrous.
  - *b.* Bead coloured.
    - 1. Form a slag or scoria.
    - 2. Form a perfect bead or globule.

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* The assay should be the size of a common pin's head.

† Decrepitation is not a permanent character, even in specimens of the same species, e. g. fluor spar and sulphate of barytes.

B. *Without* exfoliation, intumescence, or effervescence.
- *a*. Bead colourless or white.
  1. Anhydrous.
  2. Hydrous.
- *b*. Bead-coloured.
  1. Not metallic nor magnetic.
  2. Metallic or magnetic.

Div. II.—Fuse on the edge, but do not form a bead.
- *a*. Fused portion colourless or white.
  1. Anhydrous.
  2. Hydrous.
- *b*. Fused portion coloured or black.
  1. Not magnetic.
  2. Magnetic.

Class II.—INFUSIBLE.

Order I.—Effervesce with Acids or with Borax.

Order II.—Do not effervesce with Acids or with Borax.

Div. I.—Hardness under 6, or yield to the knife.

Div. II.—Hardness above 6, resist the knife.

APPENDIX.

Minerals not arranged.

CLASS I.

Order I.

I. Division.—*Combustible* with *flame*.

1. Sulphur. Pale yellow colour, burns with a blue flame, and suffocating odour.

2. Amber. Yellow, becomes electric by friction with a piece of silk or woollen cloth, and attracts light bodies.

3. Bituminous Wood. Brownish black, burns with a weak flame.

4. Bituminous Coal. Black, burns with a bright flame and much smoke.

II. Division.—*Combustible* without *flame*.

5. Gray Antimony. Heavy, melts first, and emits strong sulphurous odour.

6. Anthracite. Light, colour black, burns slowly.

7. Graphite. Grayish black, soils paper, burns *very slowly*.

Order II.—Incombustible.

I. Division.—*Fuse into a slag or bead.*

A. *With* exfoliation, intumescence, or effervescence.

a. Bead colourless or white.

1. Anhydrous.

8. Prehnite. Pale yellowish green, fuses readily with borax.
9. Scapolite. With borax it fuses with effervescence until the assay is entirely dissolved.
10. Spodumene. Contains lithia, and tinges the flame carmine red, when its proper flux or test is used.
11. Pearlstone. Occurs in globular concretions, and fuses with some difficulty.

2. Hydrous.

12. Selenite. Exfoliates or curls up; yields to the nail.
13. Stilbite. Ditto, ditto.
14. Heulandite. Ditto, ditto, high pearly lustre.
15. Apophyllite. Ditto, ditto, square prisms, or some with four-sided pyramids.
16. Thompsonite. Ditto, ditto, in long radiating prisms.
17. Skolezite. Ditto, ditto, ditto.
18. Chabasie or Levyne. Intumesces much, does *not* gelatinize in warm nitric acid.
19. Laumonite. Gelatinizes, in nitric acid.
20. Mesole. Ditto, ditto, in globules of a radiated structure.
21. Chalilite. Ditto, ditto, amorphous, colour reddish or yellow.
22. Killinite. Found only in granite at Killiney, county of Dublin.

Note.—Nos. 13 to 21, inclusive, are found only in trap rocks, and chiefly in the north of Ireland.

b. Bead coloured.

1. Form a slag or scoria.

23. Epidote or Zoisite. Baikalite.
24. Dark-green Tourmaline.

2. Form a smooth bead.

25. Idocrase. Hardness = 6·0.
26. Talc. Soft, in thin laminæ, not elastic.
27. Mountain Cork. Amorphous, yields to the nail.

Order II.

I. Division.—*Fuse into a slag or bead.*

B. *Without* exfoliation, intumescence, or effervescence.

a. Bead colourless or white.

1. Anhydrous.

28. Fluate of Lime. Purple colour, corrodes glass when heated with sulphuric acid, crystals cubic.
29. Sulphate of Barytes. Heavy.
30. Sulphate of Strontia.
31. Phosphate of Lead. Forms a polygonal bead, and yields lead when fused with carbonate of soda.

2. Hydrous.

32. Gypsum or Vulpenite. Soft.
33. Erinite. Soft.
34. Hydrolite.
35. Philipsite.
36. Harmotome. In quadrangular prisms, forming macles.
37. Natrolite or Lehuntite. Fuses slowly with borax.
38. Mesotype.
39. Antrimolite.
40. Harringtonite.
41. Analcime.

Note.—Nos. 32 to 41, inclusive, are found in the trap districts, chiefly in the north of Ireland. Harmotome occurs on granite in the county of Wicklow.

b. Bead coloured.

1. Not metallic nor magnetic.

42. Essonite. Amorphous, bead translucent, greenish.
43. Garnet. Crystallized, bead black.
44. Chlorite. Green, soft, granular, amorphous.
45. Kirwanite.
46. Actinolite.
47. Hornblende.
48. Augite.
49. Lievrite.
50. Pitchstone.

2. Metallic or magnetic.

51. Gold.
52. Copper. A malleable bead.
53. Red Oxide of Copper, Tile Ore. Ditto.
54. Black Oxide of Copper. Ditto.
55. Green Carbonate. Effervesces with acid.
56. Blue Carbonate. Ditto.
57. Brittle Silver Ore.

58. Galena.
59. Carbonate of Lead. Effervesces with acid.

The Nos. 51 to 59 yield a malleable bead.

60. Vitreous Copper.
61. Purple Copper.
62. Fahl Ore.
63. Copper Pyrites.
64. Sulphuret of Nickel. In delicate acicular crystals.
65. Grey Cobalt. Colours borax deep amethyst colour.
66. Red Cobalt. Ditto.
67. Wolfram.

ORDER II.

II. Division.—*Fuse on the edge, but do not form a bead.*

a. Fused portion colourless or white.

1. Anhydrous.

68. Asbestus. Fibrous.
69. Amianthus. Ditto.
70. Tremolite. Ditto.
71. Pinite. Six-sided prisms, hardness = 2·5.
72. Apatite. Ditto, hardness = 5·0.
73. Sahlite.
74. Felspar. Hardness = 6·0.
75. Adularia. Ditto.
76. Albite. Ditto.
77. Moonstone. Ditto.
78. Labradorite. Ditto.
79. Iolite.
80. Indicolite. Dark blue, in long prisms.
81. Beryl. In six-sided prisms.

2. Hydrous.

82. Plinthite.
83. Steatite.
84. Serpentine.
85. Schillerspar.
86. Chiastolite.

b. Fused portion, coloured or black.

1. Not magnetic before or after roasting.

87. Mica. Soft in elastic laminæ.
88. Red Manganese. Colours borax deep purple.
89. Calamine. Effervesces with borax.
90. Blende. In a strong heat its edges round off, but do not fuse; it is yellow while warm.
91. Sphene.

2. Magnetic before or after roasting.

92. Carbonate of Iron. Effervesces with borax.
93. Red Hematite. Streak red.

94. Brown Hematite. Streak yellowish brown.
95. Specular Iron, Micaceous. Streak red, transmits a red colour.
96. Magnetic Iron-stone. Magnetic before roasting.
Magnetic Iron-sand. Ditto.
97. Oxydulous Iron. Ditto.
98. Arsenical Iron. Emits smell of arsenic.
99. Iron Pyrites. Emits smell of sulphur.
100. Clay Iron-stone.
101. Meadow Iron Ore.
106. Nigrine.
107. Phosphate of Iron.

Class II.—INFUSIBLE.

Order I.—Effervesce with Acids or with Borax.

108. Calcareous Spar.
Schiefer Spar.
Rock Milk.
Chalk.
Swinestone.
Dolomite.
109. Arragonite. Contains Strontia.
110. Pearl Spar.
111. Carbonate of Magnesia.
112. Carbonate of Strontia. Colours the flame carmine red.
113. Carbonate of Zinc.

Order II.—Do not effervesce with Acids or Borax.

Div. I.—*Hardness under* 6·0, *or yield to the knife.*

114.	Nacrite,	,,	= 2·25.	In small scales.
115.	Lithomarge,	,,	2·5.	Amorphous.
116.	Rhodalite,	,,	2·0.	
117.	Wavellite,	,,	3·5.	In radiated globules.
118.	Earthy manganese,	,,	1·0.	Colours borax deep purple.
119.	Compact.			Ditto.
120.	Grey.			Ditto.

Div. II.—*Hardness above* 6·0, *or resist the knife.*

121. Tinstone.
122. Chrome iron. Colours borax green of rich colour.
123. Rutile.
124. Grenatite.
125. Andalusite.
126. Quartz, rock-crystal, &c.
127. Olivine.
128. Topaz.
129. Corundum.

APPENDIX.

Containing minerals mentioned in the Catalogue of Giesecké, &c., but not included in the foregoing arrangement:—

No. in Giesecké's Catalogue,	76.	Porcelain clay.
,,	77.	Pipe do.
,,	78.	Slate do.
,,	79.	Clay-stone.
,,	80.	Tripoli.
,,	81.	Alumstone.
,,	82.	Bituminous slate.
,,	83.	Drawing slate.
,,	84.	Whet slate.
,,	85.	Clay slate.
,,	86.	Alum slate.
,,	89.	Potstone.
,,	99.	Wacke.
,,	100.	Iron clay.
,,	101.	Green earth.
,,	103.	Bole.
,,	104.	Cimolite.
,,	107.	Nephrite.
,,	158.	Slaggy mineral pitch.
,,	159.	Bog tallow.
,,	222.	Orthite.

GENERAL LAWS OF THE EFFECT OF HEAT, FLUXES, ETC., ON THE EARTHY MINERALS. DEDUCED FROM EXPERIMENTS BY A. SMITH.

1st Class.—Compounds of *Silex*, *Alumina*, Iron, Water, &c.

In the forceps most of them are infusible, those containing a large portion of iron glaze or fuse on the edge, in proportion to the quantity of iron they contain; with borax, they are almost insoluble. The anhydrous species are hard: those which contain water in chemical combination are rather soft. They all become blue when heated with solution of nitrate of cobalt, except such as contain iron.

2nd Class.—Compounds of *Silex*, *Alumina*, *Alkalies*, Iron, Water, &c.

In the forceps they all fuse quietly (?) on the edge: some form a bead. With borax, most of them dissolve slowly; a few more readily. The anhydrous species are harder than the hydrous: some of the latter gelatinize in nitric acid.

3rd Class.—Compounds of *Silex*, *Alumina*, *Lime*, Iron, Water, &c.

In the forceps all fuse, most of them with intumescence, and form a bead readily. With borax, all dissolve; many speedily, some slowly. Hardness of the anhydrous species generally from 6 to 7; of the hydrous, from 3 to 5.

4th Class.—Compounds of *Silex*, *Alumina*, *Magnesia*, Iron, Water, &c.

In the forceps all fuse on the edge; some form a bead. With borax, all dissolve; some speedily, some slowly.

5th Class.—Compounds of *Lime* and *Acids*.

The carbonates are infusible; the others are fusible. With borax, all dissolve; some speedily, the carbonates with effervescence.

6th Class.—Compounds of *Silex*, *Magnesia*, Iron, Water, &c.

Infusible, or fuse slowly on the edge. With borax, dissolve very slowly.

7th Class.—Compounds of *Silex*, *Magnesia*, and *Lime*.

All fusible; some readily, some on the edge. All soluble in borax; some readily, some slowly.

8th Class.—Compounds of *Baryta*, *Strontia*, and *Acids*.

VIII. — The Localities of the Irish Carboniferous Fossils, arranged according to the Stratigraphical Subdivisions of the Carboniferous System adopted in the Geological Map of Ireland, with the Irish Mining Localities as appended to the Synoptical Table of Fossils, engraved on the Margin of that Map, and as originally compiled for the Use of the General Valuation of Ireland.

By Sir Richard Griffith, Bart., LL.D., F.G.S., &c., &c.

[Read March 10, 1860.]

The synopsis of the fossils collected by me from the Carboniferous Limestone of Ireland, as at present contained in my cabinet, was originally intended to form a portion of an extended work, explanatory of the details of my Geological Map; but duties of a public nature having hitherto prevented the execution of my design, I am induced to submit to the members of the Geological Society of Dublin, the authentic Tables, originally prepared according to my views of the natural subdivisions of the Carboniferous Limestone system of Ireland, and engraved, in a condensed form, in the years 1853–4–5, on the margin of the map before mentioned.

The want of a general geological description has, however, in some measure been supplied by the publication, in the "Journal of the Geological Society of Dublin," of numerous papers which, on various occasions, became necessary to explain or defend the views of the Carboniferous System as developed in Ireland which I have adopted; and I may mention, that, with a view to a more extended circulation of the "Synopsis of the Characters of the Carboniferous Limestone Fossils of Ireland," I intend to offer to the public the copies of that work now remaining in my possession, with an adaptation of the following Tables appended, by which I hope to render the work more generally useful than it has hitherto been.

In my original examinations of the country, I found that its local peculiarities naturally suggested other stratigraphical subdivisions and wider generalizations than were supplied by any arrangements existing at the time, and which were principally applicable to England; and in this view, while adhering as much as possible to the systems of preceding geologists, I did not scruple to make such modifications and additions as appeared to me necessary to exhibit clearly the true stratigraphical succession presented by the rocks of which our Carboniferous Limestone system is composed; and this object was not finally completed until I had thoroughly examined, in every part of Ireland, the succession of these strata as they occurred between their immediate base, resting on the Old Red Sandstone, and their termination, at the commencement of the Coal series; and by this means I have been enabled to engraft several additional members on the Carboniferous Limestone system, which are altogether wanting, or so slightly developed, in England and Scotland, as nearly to pass unnoticed, or to be considered merely as accidental variations.

I have so frequently given descriptions, more or less detailed, in different papers and publications, relative to the several groups of which the Irish series consists, that it is almost superfluous to repeat them in this place; but to save troublesome references, I shall briefly recapitulate a few of the leading facts. I should premise that the several subdivisions in the system which I have introduced are based chiefly on lithological character and stratigraphical position, aided by fossiliferous evidence; and in regard to any group of the series which may appear to some geologists to require further elucidation, I expect to be enabled, on some future occasion, to submit the result of my continued researches to the Society.

The Carboniferous system in Ireland is separable into three leading groups, each distinguished by the difference of their lithological character and composition, as well as by the persistence of their relative positions,—this latter being strikingly exhibited in numerous sections made by me in various parts of the country, some of which I have had engraved on the margin of my Geological Map; and taking into account the agreement which the contained fossils maintain with similarity of lithological character, I am of opinion that the geological divisions adopted by me are entitled to attentive consideration.

Considering the comparatively early period at which Professor M'Coy was employed in examining the fossils described in the Synopsis above referred to, it was only to be expected that certain modifications of his views would arise as discovery advanced; but these have hitherto been chiefly limited to the genera of Brachiopoda, which have been studied with so much ability and success by Mr. Thomas Davidson, to whose works I beg to refer on the subject; but the synopsis will continue an indispensable reference for the fossils described therein for the first time, which amount to upwards of 450.

The several members of the Carboniferous system were originally proposed by me in the Report of the Irish Railway Commissioners, pre-

sented to Parliament in the year 1838; and they were further developed and matured at various meetings of the British Association, especially at that held at Manchester, in the year 1842,—ultimately assuming the complete form of which I beg now to offer the following brief description:—

Commencing at the base, the first, or Yellow Sandstone group, which rests conformably on the subjacent and hitherto non-fossiliferous Old Red Sandstone, is divisible into two members—namely, Yellow Sandstone proper, and Carboniferous Slate—the latter of which frequently assumes the character of Lower Limestone Shale, the whole group being intimately connected with the next overlying series. The first-named member consists of yellowish, white, and variously-coloured sandstones and conglomerates, having occasional interstratifications of Arenaceous Limestone and Arenaceous Shale; while the last, in ascending order, is composed of shales or argillaceous strata, occasionally alternating with limestone, in the northern and midland districts of Ireland, but which become towards the southern shore of the counties of Cork, Waterford, and Kerry, a true Carboniferous roofing-slate, having planes of cleavage.

Amongst other fossils, characteristic respectively of either subdivision, the fish remains, as *Holoptychius* of the Yellow Sandstone shales of the valley of Ballinascreen, in the county of Londonderry, and the *Posidonia* of the fissile Carboniferous Slate of the Old Head of Kinsale, in the county of Cork, may be specially mentioned.

Carboniferous plants of a remarkable character (some of which I have enumerated in the Tables engraved on the margin of my Geological Map) are found to occur at the base of this group, such as the *Sphenopteris Hibernica* and *Cyclostigma* of Kiltorcan, Tallow Bridge, &c., the large fossil-tree (*Stigmaria*), obtained by me, at Mac Swyne's Bay, in Donegal, which also occurs at the north coast of Mayo, with marine fossils, exogenous wood, &c., identifying both localities with certain German beds at Landeshut and Haynichen, many specimens of which are in the possession of Professor Haughton, besides Sigillaria, Lepidodendron, &c.; and it is probable that these descend much farther down into the Old Red Sandstone than has hitherto been supposed; upon the evidence of which, as I have elsewhere observed, it is possible that the Irish Devonian series may ultimately be included as a member of the overlying and conformable Carboniferous Series. It was in the Yellow Sandstone group, in the same beds containing the Stigmaria of Mac Swyne's Bay, that Mr. Harte, County Surveyor of Donegal, lately discovered the gigantic cabbage-like leaf, similar to the *Dictyophyllum crassinervium* of the New Red Sandstone, which we may expect to have fully described by our President on a future occasion.

Still ascending, we find, in conformable succession, the Carboniferous Limestone series, or second group of the system, which clearly exhibits a triple arrangement, being divisible into a lower and upper bluish-gray, subcrystalline, and highly fossiliferous limestone, which are separable from each other by the interposition of beds of dark-gray shale, occasionally alternating with dark-gray, impure, argillo-siliceous limestone, to which, as the middle member of the Carboniferous Limestone group, I

have applied the provincial term "Calp," originally adopted by the late Mr. Kirwan, from an expression locally used for rocks of this mineral character, which in various parts of Ireland, especially in its midland and eastern district, from Edgeworthstown to Dublin, occupy a large superficial area. The Calp series, in certain districts of the North of Ireland, consist of an upper and lower shale, having a fugitive bed of yellowish-gray sandstone intercalated, which latter disappears as we proceed to the south and east, where the Calp strata, though of moderate thickness, forms, from its superficial extent, a geological feature of much importance in an agricultural point of view, as affording valuable and improving pastures, remarkable for the production of cocksfoot and other superior feeding grasses.

The great Carboniferous Limestone plain of Ireland, which is highly fossiliferous, occupies nearly two-thirds of the country; and the soils resulting from its disintegration, though variable in quality, are of great natural fertility, becoming unusually productive upon their intermixture with granitic and other rocks in a state of decomposition. Many of the fossils which occur in the limestone group are common to the other subdivisions of the system; but distinct mineral conditions will be found to be accompanied by a corresponding peculiarity of prevailing fossils.

Resting conformably upon the Upper Carboniferous Limestone, we arrive at the strata of the Coal series, which, forming the third group of the system as arranged by me, is again divisible from its base into a millstone grit, a lower, and an upper Coal series.

The millstone-grit formation consists of an upper and lower yellowish-white sandstone, separable by the interstratification of beds of black shale, and occasionally limestone, which contain nearly every class of the ordinary Carboniferous fossils—these, however, being generally much inferior in size to those occurring in the lower members of the system.

In common with the sandstones, impressions of coal-plants also occur in these shales, and they sometimes accompany the marine remains, amongst which latter it is remarkable that *Posidonia* and *Goniatites striolatus* extend from the Carboniferous slate, at the base, to the millstone grit, at the top of the series.

The upper and lower Coal formations are characterized, as in England, by the usual plants; but the Molluscan remains, which hitherto seem to consist of only one species of fresh-water bivalve, like *Modiola* with a portion of a Trilobite, appear to have a very local existence in our coal-fields, which, notwithstanding the unusual development of the Carboniferous system in Ireland, do not justify any promise in regard to their comparative commercial value,—the bituminous coal of the country being limited to isolated districts of small extent in the North of Ireland, which have nearly, if not altogether, been worked out; and the coal-fields of the southern counties supplying only anthracite. In an agricultural point of view, lands of superior fertility are often found to occur along the boundaries of junctions between the Upper Carboniferous Limestone and the shales of the Coal series, notwithstanding the sterility usually existing in the interior districts of the latter.

I have only to hope that the foregoing brief description will be sufficient to exhibit the principles by which I have been guided in the execution of an enterprise undertaken in an unknown field, the difficulties of which, it will be admitted, could only have been overcome by the adoption of a system suited to the peculiarities of the country.

I have thought it desirable to add an appendix of the Irish mining localities, compiled from the Geological Map for the use of the General Valuation of Ireland; but I have not ventured to offer any opinion respecting their productiveness in a commercial point of view, as the development of the value of mining property is rather the concern of individual enterprise.

ABSTRACT OF CARBONIFEROUS LOCALITIES, WITH THEIR POST-TOWNS, DIVIDED INTO COUNTIES.

ANTRIM.

Saltpans, Ballycastle.
Tornaroan, Ballycastle.

ARMAGH.

Annahugh, Armagh.
Ballygasey, Loughgall.
Cabragh, Armagh.
Downs, Armagh.
Drummanbeg, Armagh.
Drummanmore, Armagh.
Enagh, Tynan.
Farmacaffy, Armagh; or Red Barn, Armagh.
Fellow's Hall, Tynan; or College Hall.
Kilmore, Armagh; or Eglish.
Lisadian, Armagh.
New Road, Armagh.
Red Barn, Armagh, or Farmacaffy.
Salter's Grange.
Tullyard, Armagh.
Tullyree, Armagh.
Tynan.

CAVAN.

Aghaboy, Swanlinbar; or Pollnagollum, Swanlinbar.
Alteen, Stream, Armagh.
Ballyconnell, Ballyconnell.
Clonkeiffy, Virginia.
Countenan, Stradone.
Cuilcagh Bridge, Swanlinbar.
Gibber Bridge, Kingscourt.
Golin, Cavan.
Kilmore, Cavan.
Killeshandra, Cavan.
Laragh, Stradone.
Pollnagollum, Swanlinbar, or Aghaboy.
Townparks, Killeshandra.
Swanlinbar.
Swellan, Cavan.
Virginia.

CARLOW.

Bannaghagole, Leighlin Bridge.
Bilboa Colliery, Carlow.
Old Leighlin, Leighlin Bridge; and Raheen, Leighlin Bridge.
Raheendoran, Carlow.

CLARE.

Belfield, Milltown Malbay.
Cahir Rush, Milltown Malbay.
Cloonlara, Clare; Meelick Chapel, Clare; Coolin, Corofin.
Derrybryan, Clare; and Inchiquin, Corofin.
Doon, Mount Phelim, Ennistymon.
Kilkee, Milltown Malbay.
Kilmacduagh, Gort; at Boston Chapel.
Meelick Chapel, Clare, or Cloonlara.
Scarriff, Killaloe.

CORK.

Annagh, Charleville.
Arraglin Bridge, Kilworth, or Fermoy.
Ballinhassig, Cork.
Banteer, Kanturk.
Bantyre, Cork.
Ballybeg, Buttevant.
Ballygarvan, Cork.
Ballymakean, Kinsale.
Blackball Head, Kenmare.
Blackrock, Cork.
Carrigaline, Cork.
Castlecree, Doneraile.
Castlerichard, Middleton.
Castlesaffron.
Castletownsend, Cork.
Cove, Cork.
Derrylief, Cork.
Doneraile, Doneraile.
Dromagh Colliery, Kanturk.
Dunally, Cork.
Dunboy Point, Castletown; Bearhaven, E. of Blackball Head.
Fortwilliam, Doneraile.
Garryvessoge, Kanturk; and Glengariff.
Gurteen Colliery, Banteer.
Gurteenroe, Bantry.
Killingley, Ballea.
Kingwilliamstown, Castleisland.
Kilkatern, Berehaven.
Ledwithstown.
Lispatrick, Cork; Old Head of Kinsale.
Little Island, Cork.
Middleton, Cork.
Nohaval, Kinsale.
Reendonoughan, Bantry.
Rinniskiddy, Cork.
Shanbally, Carrigaline.
Streamhill, Doneraile.
Tankardstown, Kildorrery.
Town of Bantry.

DONEGAL.

Abbeybay, or Abbeylands, Ballyshannon.
Aighan Bridge, Dunkineely.
Ardloughill, Ballyshannon.
Ballybodonnell, Dunkineely.
Bruckless, Dunkineely.
Bundoran, Bundoran, or Ballyshannon; Donegal Bay, West Coast.
Doorin, Donegal.
Doorin Point.
Drummeenanagh, or Thrushbank.
Drummagroagh, Ballyshannon.
Dunkineely.
Esk Lough, Donegal.
Finner, Bundoran.
Greaghs, Ballintra, or Donegal.
Inver, Donegal.
Kilcar.
Killaghtee, Dunkineely, or Donegal.
Laghy, Donegal.
Lisnapaste, Ballintra.
Mac Swyne's Bay, Dunkineely.
Rahan's Bay, Dunkineely.
St. John's Point, Dunkineely.
Spierstown, Donegal.
Stridagh Point, Donegal.
Thrushbank, or Drummeenanagh.
Tinnycahill, Donegal.

DOWN.

Castle Espie, Comber.
Cultra, Hollywood.

DUBLIN.

Baldongan, Skerries.
Ballykea, Skerries, or Drumlattery, Skerries.
Clontarf, Dublin.
Courtlough, Balbriggan.
Curkeen, Skerries, or Rush.
Drumlattery, Skerries, or Ballykea.
Flemingstown, Balbriggan.
Howth, Dublin.
Lane, Skerries.
Loughshinny, Rush.
Malahide, Malahide.
Milverton, Skerries.
Naul, Balbriggan.
Oldtown, Dublin.
Rush, Rush.
St. Doolough's, Dublin.
Salmon, Man of War, Balbriggan.
Poulscadden, Howth.
Raheny, Dublin.
Rathbale, Swords.

FERMANAGH.

Ardatrave, Kesh.
Agharainey, Kesh.
Ballylucas, Lisbellaw.
Bannaghbeg, Kesh.
Bannagh River, Kesh.
Bellanaleck, Enniskillen.
Belmore Mountain, Enniskillen.
Boa Island, Kesh; Lough Erne.
Boherroy, Churchill.
Bohevny, Enniskillen.
Bunnanniver, Kesh, or Archdall.
Callaghan, Belleek.
Carn, Ederny.
Carrigolagh, Belleek.
Carrickoughter, Kesh.
Carrickreagh, Enniskillen.
Carrowtremal, Enniskillen.
Castle Archdall.
Churchill, Vicinity of.
Clareview, Kesh, or Lisnarick.
Cleenishgarve, Enniskillen.
Corlave Bridge, Kesh.
Cornacarrow, Enniskillen.
Cornagrade, Enniskillen.
Corrick, Drumieran; Lough Leitrim.
Crevenish Island.
Curraghmore, Pettigo.
Deerpark, Ederny.
Derrygonnelly.
Derrynacapple, Kesh.
Derryvullan, Enniskillen.
Drum, Ederny.
Drumbrick, Ederny.
Drumcurren, Kesh.
Drumgowna, Kesh.
Drumieran, Ederny.
Drumkeeran, Ederny.
Drumreask, Churchill.
Erne Lough, Fermanagh.
Ederny.
Glassdrumman.
Gubbaroe, Kesh.
Kesh, Fermanagh, or Tullanaguiggy.
Kilcar, Belturbet.
Knockninny, Enniskillen.
Leam, Tempo; Moneyburn River.
Meenmossoge, Ederny.
Mullans, Boa Island, Kesh.
Oughterdrum, Belleek.
Poulafooca, Churchill, or Shean.
Scolban Lough, Belleek.
Shean, Churchill, E. of Belleek; or Poulafooca.
Ring, Enniskillen.
Tullanaguiggy, Fermanagh, or Kesh.

GALWAY.

Athenry, and between it and Tuam.
Aughliham.
Ballinfoyle.
Caheratrim, Loughrea.
Cappamoyle, Athenry.
Carrowntobber, Athenry.
Cong.
Cregganore, Gort, E. of Castleboy, or Toberellathan, and Derrybrian Mountains.
Portumna, Galway.
Toberellathan, or Cregganore.
Woodford, Loughrea.

KERRY.

Ballymacelligut, Tralee.
Brickeen Bridge, Killarney, and Brickeen Island.
Castleisland, Castleisland.
Castleogary, Tralee.
Collarus, Kenmare; Ardgroom Harbour.
Currens, Tralee, or Castleisland.
Kenmare.
Loughnacree, Kenmare; Kilmichaelogue.
Muckruss, Killarney.
Mullaun, Ballybunnion.
New Canal, Tralee.
Roughty Bridge, Kenmare.

KILDARE.

Ardclogh, Rathcoole, or Kildare.
Ardpodien, Kildare.
Boston, Rathangan.
Castledermot.
Millicent, Clane.

KILKENNY.

Coolaghy.
Firoda, Castlecomer.
Kiltorcan, Ballyhale.
Skehana, Castlecomer.

KING'S COUNTY.

Ballard.
Banagher.

LEITRIM.

Aghakilfaun, Mohill.
Aghamore, Bundoran; or Ballintrillick, Bundoran.
Ballinafad, Boyle.
Ballintrillick, Bundoran, or Aghamore.
Benbo, Manorhamilton, or Morera.
Black Lion, Enniskillen.
Bleankillew, N. of Drumod, Shannon Shore, and Cairnclonhugh Mountains, middle district.
Braulieve Mountain, Black Lion.
Cavan, Aghamore.
Corry, Drumkeeran.
Derreens, Drumkeeran.
Drumard.
Drumconny, Cloone.
Drumod, Mohill.
Fearnaght Lough Riv., Mohill.
Loughallen, Carrick-on-Shannon.
Manorhamilton, Manorhamilton.
Mohill, or Ussaun.
Morera, Manorhamilton.
Trean, Lurgan; Bar. of Mohill.
Tullyoran, Mohill.
Ussaun, or Mohill.

LIMERICK.

Chicken Hill, Kilmallock.
Foynes, Askeaton.
Kilmallock, Limerick.
Moymore, Tulla.

LONDONDERRY.

Ballynure, Maghera.
Banada, Draperstown, at Bar. Boundary, or Moneyneany.
Corick, Draperstown, or Corick Riv., or Whitewater, Cloughfin.
Cullion, Draperstown.
Desertmartin.
Dromard, Draperstown.
Fallagloon, Maghera.
Forge Bridge on Drumconready.
Moneyneany, or Banada, Draperstown.
Mormeal, Draperstown.
Moyheeland, Maghera, or Draperstown.
Slievegallion, Magherafelt.
White River, Cloughfin, Draperstown, or Corick.

LONGFORD.

Ballymahon.
Carrickboy, Longford.
Carrickduff, Granard.
Cornadowagh.
Granard, Granard.
Kilcommock, Longford.
Monaduff, Drumlish.
Mullawornia, Ballymahon.
Rathcline, Lanesborough.
Shrule, Ballymahon.
Tirlecken, Shrule.

LOUTH.

Carlingford, Carlingford, E. of Dromore.
Kilcurry, Dundalk.
Knockagh, Dundalk.
Millgrange.

MAYO.

Ballina.
Ballinglen, Ballycastle.
Ballycastle, Mayo.
Bunatrahir, Killala.
Crosspatrick, Killala.
Doonfeeny, Killala.
Kilbride, Ballycastle.
Kilcummin, Killala, or Lackan Bay.
Kilglass, E. of Killala Bay, North of Ballina.
Killala.
Killogunra, Killala.
Killybrone, Killala.
Larganmore, Bangor, or Crossmolina.
Moyne Shore, Killala.
Mullaghfarry, Killala.
Mweelbawn.
Swineford.
Townplots, Killala.
Westport.

MEATH.

Altmush, Nobber.
Ardagh, Drumcondra.
Ballyhoe Lake, Drumcondra.
Balsitric, Nobber.
Castletown, Trim.
Churchtown, Nobber.
Clonalvy, Balbriggan, or Flemingstown.
Cregg, Nobber.
Cruicetown, Nobber.
Cusackstown.
Drogheda.
Flemingstown, Balbriggan, or Clonalvy.
Gibstown.
Horath, Moynalty.
Laracor, Trim.
Mullaghfin, Duleek.
Paget Priory, Maynooth; a local name.
Rathgillen, Nobber.
Slane.
Walterstown, Skreen, or Navan.

MONAGHAN.

Clonturk, Carrickmacross.
Dundonagh.
Killyrean Upper, Emyvale.
Killyvilly Wood.
Lattinalbany, Carrickmacross.
Leek, Monaghan.
Monaghan.
Mullaghboy, Monaghan.
Mullaliss, Monaghan.
Mullylusty, Carrickmacross.
Tonyclida, Carrickmacross.
Tonyshanderry, Emyvale.

QUEEN'S COUNTY.

Aghafin, Castletown.
Burris, Maryborough.
Cloghan, Maryborough; a local name.
Mountrath.
Rathaspick.
Ringstown.
Roundwood.
Tinnekill, Mountmellick.

ROSCOMMON.

Aghabehy, Keadue.
Arigna, Keadue.
Ballinafad, Boyle.
Ballyglass, Strokestown.
Cahernanalt, Keadue.
Cartronaglogh, Keadue.
Cleen, Roscommon.
Crosshill, Keadue.
Derreennavoggy, Keadue.
Drum, Ballinasloe.
Drumdoe, Boyle.
Grangemore, Roscommon or Boyle.
Killukin, Carrick-on-Shannon.
Kiltullagh, Castlereagh.
Lackan, Athleague.
Lisardrea, Boyle.
Moore, Ballinasloe.
Oran, Roscommon.
Rathmoyle House, Frenchpark.
Roscommon.
Strokestown, Roscommon.
Termon, Boyle.
Toberory, Tulsk.

SLIGO.

Barnacoghill.
Ballymeeny, Easky.
Ballinafad.
Bunowna, Easky; Easky, Sligo.
Carnly, Sligo.
Carrowmably, Easky.
Carrowmacrory, Tobercurry, Easky, or Templeboy.
Carrowmore, Ballycastle, or Tobercurry.
Carrownsteelagh.
Cashelboy, or Easky.
Culleenamore, Knockanarea.
Culleenaduff, Knockanarea.
Easky, Sligo. See Bunowna and Cashelboy.
Kilglass.
Killeenduff, Easky.
Knockanarea.
Lavally, Ballymote.
Magheramore, Tobercurry.
Streedagh, Sligo.
Templeboy Par.
Tobercurry.

TIPPERARY.

Ballyporeen.
Carrigahorrig, Portumna.
Knocklofty.
Listowel, Thurles.
Nenagh.
New Birmingham, Killenaule.
Newcastle, Clogheen.

TYRONE.

Aghintain, Clogher.
Aghnaglogh, Clogher.
Annagher Colliery, Coal Island.
Annaghilla, Ballygawley.
Ballymacan, Clogher.
Benburb, Caledon.
Cavansallagh, Drumquin.
Claraghmore, Drumquin.
Clare, Cookstown.
Cookstown, Tyrone.
Callaghan, Belleek.
Derryloran.
Donaghrisk, Cookstown.
Dromore, Omagh.
Drumowen, Drumquin.
Drumreagh Etra, Dungannon.
Drumscraw, Drumquin.
Edenacrannon, Dungannon.
Edenassop, Castlederg.
Fasglassagh, Ballygawley.
Fivemiletown, Tyrone, or Rahoran.
Kildress, Cookstown.
Killycloghy, Lisbellaw or Clogher.
Killymeal, Dungannon.
Knockonny, Ballygawley.
Lackagh, Drumquin.
Lismore, Aughnacloy.
Magherenny, Drumquin.
Meenacarrighy, Drumquin.
Mullaghtinny, Clogher.
Mulnahunch, Dungannon.
Prughlish, Drumquin.
Rahoran, Fivemiletown, or Fivemiletown, Tyrone.
Roughan, Dungannon.
Scraghy, Castlederg.
Tymore Todd, Augher.
Tumpher, Dungannon, Stewardstown.

WATERFORD.

Ardoginna, or Ardoe, Youghal, Ardmore.
Balinacourty, Dungarvan.
Ballyduff, Dungarvan.
Ballyvoil Bridge, Dungarvan, and Camphire, Vale of the Bride.
Clonea, Dungarvan.
Curragh, Ardmore.
Glandine, N. of Dungarvan, and Janeville, Vale of the Bride.
Kilnamack, Clonmel.
Lismore, Waterford.
Parkdotia, Waterford.
Tallow Bridge, Waterford.
Whiting Bay, Youghal.

WESTMEATH.

Baskin, Ballymore, Athlone.

WEXFORD.

Hook Head, Fethard, E. side Waterford Harbour.
Kylenamelly, Enniscorthy.
Lumsdin's Bay, Fethard.
Woarwoy Bay, Fethard.

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Species.		
Bellerephon	apertus, . .	Horath, Moynalty, ...	Limestone of the Carboniferous Slate.
"	"	Lackagh, Drumquin, . . .	Carboniferous Slate.
"	"	Drumscraw, Drumquin, . .	Yellow Sandstone.
"	cornu-arietis,	Magherenny, Drumquin, . .	Carboniferous Slate.
"	hiulcus, . . .	Killaghtee, Dunkineely, . .	Yellow Sandstone and Arenaceous Limest.
GASTEROPODA.			
PECTINIBRANCHIATA, DIVIDED INTO ZOOPHAGA & PHYTOPHAGA.			
Macrocheilus	canaliculatus,	Kilcummin, Killala Bay, . .	Yellow Sandstone.
"	curvilineus, .	Bruckless, Dunkineely, . . .	"
"	fimbriatus, .	Dromard, Draperstown, . .	"
"	ovalis, . . .	Bruckless, Dunkineely, . . .	"
Loxonema	constricta, . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	polygyra, . .	Cullion, Draperstown, . . .	Yellow Sandstone.
"	pulcherrima, .	Lackagh, Drumquin, . . .	"
"	sulcatula, .	Carrickoughter, Kesh, . . .	"
"	sulculosa, . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	tumida, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
Turritella	acicula, . . .	Drumquin, ...	Arenaceous Limestone.
"	tenuistria, . .	Horath, Moynalty, ...	Limestone of the Carboniferous Slate.
Turbo	spirata, . . .	Killala, Killala, ...	Carboniferous Slate.
Naticopsis	elongata, . .	Castle Espie, Comber, . . .	Arenacous Limesteone.
"	plicistria, . .	Swellan, Cavan, ...	Limestone of the Carboniferous Slate.
"	"	Fivemiletown, Fivemiletown,	"
"	spirata, . . .	Horath, Moynalty, ...	"
"	"	Tinnycahill, Donegal, . . .	Yellow Sandstone and Arenaceous Limest.
Euomphalus	acutus, . . .	Malahide, Malahide, ...	Carboniferous Slate.
"	æqualis, . .	Countenan, Stradone, . . .	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . . .	"
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	calyx, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	catillus, . . .	Granard, Granard, ...	"
"	"	Horath, Moynalty, ...	Limestone of the Carboniferous Slate.
"	elongatus, . .	Ballinglen, Ballycastle, . . .	Yellow Sandstone.
"	marginatus, .	Balsitric, Nobber, ...	"
"	pentangulatus,	Ring, Enniskillen, ...	Limestone of the Carboniferous Slate.
"			
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Rahan's Bay, Dunkineely, .	"

CATALOGUE OF THE IRISH CARBONIFEROUS FOSSILS, &c.

Section I.

The first Portion of the Carboniferous Series, or Yellow Sandstone group, consists of four subdivisions, namely, Yellow Sandstone proper, Carboniferous Slate or Lower Limestone Shale, Arenaceous Shale, and Arenaceous Limestone.*

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
MOLLUSCA.			
Cephalopoda.			
ORTHOCERATIDÆ.			
Orthoceras	attenuatum, .	Kilbride, Ballycastle, . . .	Yellow Sandstone.
"	"	Monaduff, Drumlish, . . .	"
"	cylindraceum,	Malahide, Malahide, ...	Carboniferous Slate & Arenaceous Limest.
"	filiferum, . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Loxoceras	incomitatum,	Cove, Cork, ...	"
"	laterale, . .	Lisnapaste, Ballintra, . . .	"
"	"	Drumscraw, Drumquin, . .	Yellow Sandstone.
Actinoceras	giganteum, .	Castle Espie, Comber, . . .	Arenaceous Limestone.
"	pyramidatum,	Castle Espie, Comber, . . .	Arenaceous Limestone.
Phragmoceras	flexistria, . .	Killycloghy, Lisbellaw, . . .	Yellow Sandstone.
NAUTILIDÆ.			
Goniatites	Gibsoni, . .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	intercostalis, .	Crosspatrick, Killala, . . .	"
"	reticulatus, .	Mullaghtinny, Clogher, . .	"
"	striatus, . .	Drumscraw, Drumquin, . .	Yellow Sandstone.
"	striolatus, . .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Kinsale, ...	Carboniferous Slate or Yellow Sandstone.
Clymenia	sagittalis, . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
Discites	oxystomus, .	Drumscraw, Drumquin, . .	"
"	sulcatus, . .	Mullaghfarry, Killala, . . .	Carboniferous Slate.
"	"	Ring, Enniskillen, ...	Carboniferous Slate & Arenaceous Limest.
"	"	Crosspatrick, Killala, . . .	"
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	tetragonus, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate
Temnocheilus	biangulatus, .	Granard, Granard, ...	Yellow Sandstone and Arenaceous Limest.
"	porcatus, . .	Townparks, Killeshandra, .	Yellow Sandstone.
"	tuberculatus, .	Kilbride, Ballycastle, . . .	"

* Arenaceous Shale is not specified, but included under the term Yellow Sandstone, with which it frequently alternates.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Bellerephon	apertus, . .	Horath, Moynalty, ...	Limestone of the Carboniferous Slate.
"	"	Lackagh, Drumquin, . . .	Carboniferous Slate.
"	"	Drumscraw, Drumquin, . .	Yellow Sandstone.
"	cornu-arietis,	Magherenny, Drumquin, . .	Carboniferous Slate.
"	hiulcus, . . .	Killaghtee, Dunkineely, . .	Yellow Sandstone and Arenaceous Limest.
GASTEROPODA.			
PECTINIBRANCHIATA, DIVIDED INTO ZOOPHAGA & PHYTOPHAGA.			
Macrocheilus	canaliculatus,	Kilcummin, Killala Bay, . .	Yellow Sandstone.
"	curvilineus, .	Bruckless, Dunkineely, . . .	"
"	fimbriatus, .	Dromard, Draperstown, . .	"
"	ovalis, . . .	Bruckless, Dunkineely, . . .	"
Loxonema	constricta, . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	polygyra, . .	Cullion, Draperstown, . . .	Yellow Sandstone.
"	pulcherrima, .	Lackagh, Drumquin, . . .	"
"	sulcatula, .	Carrickoughter, Kesh, . . .	"
"	sulculosa, . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	tumida, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
Turritella	acicula, . . .	Drumquin, ...	Arenaceous Limestone.
"	tenuistria, . .	Horath, Moynalty, ...	Limestone of the Carboniferous Slate.
Turbo	spirata, . . .	Killala, Killala, ...	Carboniferous Slate.
Naticopsis	elongata, . .	Castle Espie, Comber, . . .	Arenacous Limesteone.
"	plicistria, . .	Swellan, Cavan, ...	Limestone of the Carboniferous Slate.
"	"	Fivemiletown, Fivemiletown,	"
"	spirata, . . .	Horath, Moynalty, ...	"
"	"	Tinnycahill, Donegal, . . .	Yellow Sandstone and Arenaceous Limest.
Euomphalus	acutus, . . .	Malahide, Malahide, ...	Carboniferous Slate.
"	æqualis, . .	Countenan, Stradone, . . .	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . . .	"
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	calyx, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	catillus, . . .	Granard, Granard, ...	"
"	"	Horath, Moynalty, ...	Limestone of the Carboniferous Slate.
"	elongatus, . .	Ballinglen, Ballycastle, . . .	Yellow Sandstone.
"	marginatus, .	Balsitric, Nobber, ...	"
"	pentangulatus,	Ring, Enniskillen, ...	Limestone of the Carboniferous Slate.
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Rahan's Bay, Dunkineely, .	"

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Euomphalus	quadratus, . .	Mullaghtinny, Clogher, . .	Carboniferous Slate.
"	rotundatus, .	Malahide, Malahide, ...	"
"	serpens, . . .	Clonea, Dungarvan, ...	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	tabulatus, . .	Lackagh, Drumquin, . . .	Yellow Sandstone and Arenaceous Limest.
"	"	Granard, Granard, ...	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
Pleurotomaria	altavittata, .	Drumgowna, Kesh, ...	Yellow Sandstone.
"	canaliculata, .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Doorin, Donegal, ...	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . . .	"
"	concentrica, .	Ring, Enniskillen, ...	Limestone of the Carboniferous Slate.
"	conica, . . .	Donegal, Donegal, ...	Yellow Sandstone.
"	tornatilis, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Murchisonia	elongata, . .	Dromard, Draperstown, . .	Yellow Sandstone.
"	Larcomi, . .	Leam, Moneyburn River, . .	Limestone of the Carboniferous Slate.
Elenchus	antiquus, . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
SCUTIBRANCHIA AND CYCLOBRANCHIA.			
Fissurella	elongata, . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Acroculia	Sigmoidalis, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	triloba, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	tubifer, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	vetusta, . .	"	"
Patella	mucronata, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	scutiformis, .	Lackagh, Drumquin, . . .	"
DITHYRA.			
MACROTRACHIA.			
Teredo (?)	antiqua, . .	Fasglassagh, Ballygawley, .	Limestone of the Carboniferous Slate.
Sanguinolites	angustatus, .	Tinnycahill, Donegal, . . .	"
"	"	Lackagh, Drumquin, . . .	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . .	"
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	arcuatus, . .	Ring, Enniskillen, ...	Limestone of the Carboniferous Slate.
"	costellatus, .	Killycloghy, Lisbellaw, . .	Yellow Sandstone.
"	discors, . . .	Bruckless, Dunkineely, . . .	"
"	Iridinoides, .	Drumquin, Drumquin, . . .	"

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Species.		
Sanguinolites	Iridinoides, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	plicatus, . .	Lackagh, Drumquin, . . .	Yellow Sandstone.
,,	,,	Bruckless, Dunkineely, . .	,,
,,	,,	Bunatrahir, ...	,,
,,	sulcatus, . .	Kilbride, Ballycastle, . . .	,,
,,	transversus, .	Kilcummin, Lackan Bay, .	,,
,,	tricostatus, .	Killala, Killala, ...	Carboniferous Slate.
,,	undatus, . .	Mullaghtinny, Clogher, . .	,,
Anatina	attenuata,. .	Townplots, Killala, ...	,,
,,	deltoidea, . .	,, ,, ...	,,
Pandora	clavata, . .	Carrowmacrory, Tobercurry,	Yellow Sandstone.
Mactra	ovata, . . .	Killala, Killala, ...	Carboniferous Slate.
Kellia	gregaria, . .	Cultra, Hollywood, ...	Yellow Sandstone.
Venus	centralis, . .	Cullion, Draperstown, . . .	,,
,,	tenuistriata, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Pullastra	bistriata, . .	Poulscadden, Howth, . . .	,,
,,	crassistria, .	Crosspatrick, Killala, . . .	,,
,,	elliptica, . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
,,	,,	Drumquin, Drumquin, . . .	Carboniferous Slate.
,,	ovalis, . . .	Lisnapaste, Ballintra, . . .	,,
Astarte	gibbosa, . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
,,	quadrata, . .	Ballymeeny, Easky, ...	Carboniferous Slate.
Cyprina	Egertoni, . .	Horath, Moynalty, ...	Yellow Sandstone.
,,	,,	Bruckless, Dunkineely, . .	,,
Pleurorhynchus	aliformis, . .	Howth, Howth, ...	Carboniferous Slate.
,,	,,	Poulscadden, Howth, . . .	,,
,,	,,	Hook Head, Fethard, . . .	,,
,,	,,	Malahide, Malahide, ...	,,
,,	,,	Ballinacourty, Dungarvan, .	,,
,,	armatus, . .	Poulscadden, Howth, . .	,,
,,	fusiformis, .	Malahide, Malahide.	,,
,,	,,	,, ,, ...	,,
,,	giganteus, .	St. John's Point, Dunkineely,	,,
,,	,,	Balsitric, Nobber, ...	Yellow Sandstone.
,,	,,	Mullylusty, Carrickmacross,	,,
,,	minax, . . .	Bruckless, Dunkineely, . .	,,
,,	,,	Poulscadden, Howth, . . .	Carboniferous Slate.
,,	trigonalis, .	Lisnapaste, Ballintra, . . .	,,
Cypricardia	alata, . . .	Arraglin Bridge, Kilworth, .	Yellow Sandstone.
,,	,,	Bruckless, Dunkineely, . .	,,
,,	concinna, . .	Cullion, Draperstown, . . .	,,
,,	cylindrica, .	Arraglin Bridge, Kilworth, .	,,
,,	minima, . .	Cullion, Draperstown, . . .	,,
,,	Modiolaris, .	Townplots, Killala, . . .	Limestone of the Carboniferous Slate.
,,	oblonga, . .	Arraglin Bridge, Kilworth, .	Yellow Sandstone.
,,	quadrata, . .	,, ,, .	,,
,,	rhombea, . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	,,	Lackagh, Drumquin, . . .	Yellow Sandstone.
,,	sinuata, . .	Arraglin Bridge, Kilworth, .	,,
,,	socialis, . .	Leam, Tempo, ...	Limest. of Carb. Slate.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Cypricardia	tumida, . .	Larganmore, Bangor, . . .	Yellow Sandstone.
Sedgwickia	attenuata, .	River Banagh, Drumcurren,	,,
,,	bullata, . .	Cullion, Draperstown, . . .	,,
,,	gigantea, . .	Carrowmacrory, Templeboy,	,,
,,	globosa, . .	Cullion, Draperstown, . . .	,,
Axinus	axiniformis, .	Mullaghtinny, Clogher, . .	Carboniferous Slate.
,,	,,	Larganmore, Bangor, . . .	Yellow Sandstone.
,,	carbonarius, .	,, ,, . . .	,,
,,	,,	Kilcummin, Lackan Bay, .	,,
,,	centralis, . .	Ardshankill, Boa Island, . .	,,
,,	deltoideus, .	Bruckless, Dunkineely, . .	,,
,,	nuculoides, .	Dromard, Draperstown, . .	,,
,,	obliquus, . .	Mullaghtinny, Clogher, . .	Carboniferous Slate.
,,	obovatus, . .	,, ,, . .	,,
Dolabra	attenuata, .	Derrylief, Cork, ...	Yellow Sandstone.
,,	equilateralis,	Doorin, Donegal, ...	,,
,,	gregaria, . .	Mullaghtinny, Clogher, . .	Carboniferous Slate.
,,	orbicularis, .	*See* Axinus centralis, . . .	Yellow Sandstone.
,,	securiformis,	Rahan's Bay, Dunkineely, .	,,
ATRACHIA.			
Nucula	attenuata, .	Drumquin, Drumquin, . . .	,,
,,	birostrata, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	brevirostris, .	Drumquin, Drumquin, . . .	Yellow Sandstone.
,,	carinata, . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	clavata, . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
,,	cylindrica, .	Townparks, Killeshandra, .	,,
,,	gibbosa, . .	Bruckless, Dunkineely, . .	,,
,,	,,	Lackagh, Drumquin, . . .	,,
,,	leiorhynchus,	Larganmore, Bangor, . . .	,,
,,	longirostris, .	Mullaghtinny, Clogher, . .	Carboniferous Slate.
,,	oblonga, . .	Monaduff, Drumlish, . . .	Yellow Sandstone.
,,	Phillipsii, . .	Bruckless, Dunkineely, . .	,,
,,	,,	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	rectangularis,	,, ,, . . .	,,
,,	stilla, . . .	Dromard, Draperstown, . .	Yellow Sandstone.
,,	unilateralis, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Cucullæa	tenuistria, . .	Ballybodonnell, Dunkineely,	Yellow Sandstone.
Byssoarca	lanceolata, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Crenella	acutirostris, .	Bruckless, Dunkineely, . .	Yellow Sandstone.
Modiola	amygdalina, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	concinna, . .	Townparks, Killeshandra, .	Yellow Sandstone.
,,	divisa, . . .	Larganmore, Bangor, . . .	Carboniferous Slate.
,,	lingualis, . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
,,	Macadami, .	Aghnaglogh, Clogher, . . .	Carboniferous Slate.
,,	megaloba, . .	*See* Axinus centralis, . . .	Yellow Sandstone.
,,	subparallela, .	Ballinglen, Ballycastle, . .	,,
Mytilus	comptus, . .	Carrowmacrory, Tobercurry,	Carboniferous Slate.
Inoceramus	vetustus, . .	Killaghtee, Dunkineely, . .	Yellow Sandstone.
Meleagrina	rigida, . . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Meleagrina	tesselata, . .	St. Doolough's, Dublin, . .	Carboniferous Slate.
Pteronites	angustatus, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	ventricosus, .	*See* Axinus centralis, . . .	
Avicula	angusta, . .	Rahan's Bay, Dunkineely, .	"
"	cycloptera, .	Mohill, Mohill, ...	Carboniferous Slate.
"	informis, . .	Killogunra, Killala, ...	"
"	laminosa, . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	Thompsoni, .	Rahoran, Fivemiletown, . .	Carboniferous Slate.
"	Verneuillii, .	Drumcurren, Kesh, ...	Yellow Sandstone.
Pinna	flexicostata, .	Bunowna, Easky, ...	Carboniferous Slate.
"	mutica, . . .	Kilbride, Ballycastle, . . .	Yellow Sandstone.
Lingula	squamiformis,	Leam, Tempo, ...	Carboniferous Slate.
Malleus	orbicularis, .	FearnaghtLough,RiverMohill,	"
Lima	concinna, . .	Ballinglen, Ballycastle, . .	Yellow Sandstone.
"	planicostata,	Bruckless, Dunkineely, . .	"
Pecten	arachnoideus,	Brickeen Bridge, Killarney,	Carboniferous Slate.
"	"	Ballinacourty, Dungarvan, .	"
"	bellis, . . .	Rahoran, Fivemiletown, . .	"
"	concavus, . .	Killogunra, Killala, ...	"
"	conoideus, . .	Townplots, Killala, ...	"
"	consimilis, .	*See* Atrypa nana, ...	"
"	depilis, . . .	Townplots, Killala, ...	"
"	duplicicosta, .	Larganmore, Bangor, . . .	"
"	ellipticus, . .	Countenan, Stradone, . . .	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . .	"
"	"	Doorin, Donegal, ...	"
"	fallax, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Rahan's Bay, Dunkineely, .	Yellow Sandstone.
"	"	Malahide, Malahide, . . .	Carboniferous Slate.
"	granosus, . .	St. Doolough's, Dublin, . .	?
"	granulosus, .	Greaghs, Ballintra, ...	"
"	"	Clonea, Dungarvan, ...	"
"	Hardingii, .	Lisnapaste, Ballintra, . . .	"
"	incrassatus, .	" " . . .	"
"	interstitialis, .	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	"	Kilbride, Ballycastle, . . .	"
"	irregularis, .	Rahoran, Fivemiletown, . .	Carboniferous Slate.
"	Knockonniensis, ...	Knockonny, Ballygawley, .	"
"	macrotis, . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	megalotis, . .	Poulscadden, Howth, . . .	Carboniferous Slate.
"	micropterus, .	Killycloghy, Lisbellaw, . .	"
"	mundus, . .	Lisnapaste, Ballintra, . . .	"
"	Murchisoni, .	" " . . .	"
"	"	Townparks, Killeshandra, .	Yellow Sandstone.
"	pera, ...	Townplots, Killala, ...	Carboniferous Slate.
"	plicatus, . .	Mohill, Mohill, ...	Limestone of the Carboniferous Slate.
"	polytrichus, .	Bruckless, Dunkineely, . .	Yellow Sandstone.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Pecten	quinquelineatus, . . .	Mohill, Mohill, 2	Carboniferous Slate.
"	rugulosus, .	Doorin, Donegal, 2	Yellow Sandstone.
"	semicircularis,	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	scalaris, . .	Mohill, Mohill, ...	Carboniferous Slate.
"	serratus, . .	Lisnapaste, Ballintra, . . .	"
"	simplex, . .	Cullion, Draperstown, . . .	Yellow Sandstone.
"	Sowerbii, . .	Bruckless, Dunkineely, . .	"
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	"
"	spinulosus, .	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	transversus, .	Clonea, Dungarvan, ...	Carboniferous Slate.
"	undulatus, .	Lisnapaste, Ballintra, . . .	"
Monotis	æqualis, . .	Cullion, Draperstown, . . .	Yellow Sandstone.
BRACHIOPODA.			
Orbicula	quadrata, . .	Rahan's Bay, Dunkineely, .	"
"	trigonalis, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Producta	aculeata, . .	Kilbride, Ballycastle, . . .	Yellow Sandstone.
"	"	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	antiquata, .	Lisnapaste, Ballintra, . . .	"
"	caperata, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Currens, Castle Island, . .	Carboniferous Slate.
"	"	Clonea, Dungarvan, ...	"
"	"	Doorin, Donegal, ...	Yellow Sandstone.
"	"	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	concinna, . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	"	Drumscraw, Drumquin, . .	"
"	"	Malahide, Malahide, . . .	Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Poulscadden, Howth, . . .	"
"	corrugata, .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Rahan's Bay, Dunkineely, .	Yellow Sandstone.
"	elegans, . .	Bruckless, Dunkineely, . .	"
"	fimbriata, . .	Kilbride, Ballycastle, . . .	"
"	fragaria, . .	Poulscadden, Howth, . . .	Carboniferous Slate.
"	"	Clonea, Dungarvan, ...	"
"	gigantea, . .	Castle Espie, Comber, . . .	Arenaceous Limestone.
"	granulosa, .	Poulscadden, Howth, . . .	Carboniferous Slate.
"	hemisphærica,	Lackagh, Drumquin, . . .	Yellow Sandstone.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	interrupta, .	Ballinacourty, Dungarvan, .	"
"	latissima, . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Species.		
Producta	laxispina, . .	Castle Espie, Comber, . . .	Arenaceous Limestone.
"	lobata, . . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	"	Lackagh, Drumquin, . . .	"
"	longispina, .	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	"
"	"	Lisnapaste, Ballintra, . . .	"
"	margaritacea,	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Mohill, Mohill, ...	"
"	Martini, . .	Lackagh, Drumquin, . . .	"
"	"	Newcastle, Clogheen, . . .	"
"	membranacea,	Ballinacourty, Dungarvan, .	"
"	"	Lisnapaste, Ballintra, . . .	"
"	mesoloba, . .	Townparks, Killeshandra, .	Yellow Sandstone.
"	ovalis, . . .	Donegal, Donegal, ...	"
"	pectinoides, .	Greagh's, Ballintra, ...	Carboniferous Slate.
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	prælonga, . .	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Clonea, Dungarvan, ...	Carboniferous Slate.
"	pugilis, . . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"			
"	"	Malahide, Malahide, . . .	Carboniferous Slate.
"	punctata, . .	Lackagh, Drumquin, . . .	"
"	"	Malahide, Malahide, ...	"
"	pustulosa, . .	Lisnapaste, Ballintra, . . .	"
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	quincuncialis,	Granard, Granard, ...	Yellow Sandstone and Arenaceous Limest.
"	"	Townparks, Killeshandra, .	Yellow Sandstone.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	"	Mohill, Mohill, ...	"
"	rugata, . . .	Poulscadden, Howth, . . .	"
"	"	Ballinacourty, Dungarvan, .	"
"	scabricula, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	"	Mohill, Mohill, ...	"
"	Scotica, . .	Drumkeeran, Ederny, . . .	Yellow Sandstone.
"	"	Scraghy, Castlederg, ...	"
"	"	Dromore, Omagh, ...	"
"	"	Castle Espie, Comber, . . .	Arenaceous Limestone.
"	setosa, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Producta	setosa, . . .	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Hook Head, Fethard, . .	Limestone of the Carboniferous Slate.
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Poulscadden, Howth, . . .	"
"	spinosa, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	"	Laragh, Stradone, ...	Yellow Sandstone.
"	sulcata, . . .	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Ballinacourty, Dungarvan, .	"
"	"	Rahan's Bay, Dunkineely, .	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . . .	"
"	"	Malahide, Malahide, ...	Carboniferous Slate.
Leptagonia	analoga, . .	Clonea, Dungarvan, ...	"
"	"	Currens, Castle Island, . . .	"
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Ring, Enniskillen, ...	"
"	"	Stridagh Point, Donegal, . .	"
"	"	Malahide, Malahide, ...	"
"	nodulosa, . .	Currens, Castle Island, . . .	"
"	"	Kilnamack, Clonmel, . . .	"
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	rugosa, . . .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
Leptæna	convoluta, . .	Lisnapaste, Ballintra, . . .	"
"	"	Ballinacourty, Dungarvan, .	"
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	Dalmaniana,	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	Hardrensis, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Mohill, Mohill, ...	"
"	lata ?	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	multidentata,	Ballybodonnell, Dunkineely, .	"
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	perlata, . .	Rahoran, Fivemiletown, . .	Carboniferous Slate.
"	plicata, . . .	Ardoe, Ardmore, ...	"
"	"	Clonea, Dungarvan, ...	"
"	"	Lisnapaste, Ballintra, . . .	"
"	sericea ? . .	" "	"
"	"	Ballinacourty, Dungarvan, .	"
"	sordida, . .	Lisnapaste, Ballintra, . . .	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	volva, . . .	St. Doolough's, Dublin, . .	Limestone of the Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Species.		
Orthis	arachnoidea, .	Curragh, Ardmore, ...	Carboniferous Slate.
"	"	Shanbally, Cork, ...	"
"	arcuata, . .	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	Bechei, . . .	Whiting Bay, Youghal, . .	Carboniferous Slate.
"	caduca, . . .	Rahoran, Fivemiletown, . .	"
"	circularis, . .	Lisnapaste, Ballintra, . . .	"
"	comata, . . .	Currens, Tralee, ...	"
"	crenistria, . .	Rahan's Bay, Dunkineely, .	Yellow Sandstone.
"	"	Cregganore, Gort, ...	"
"	"	Ardloughill, Ballyshannon, .	"
"	"	Currens, Castle Island, . . .	Carboniferous Slate.
"	"	Edenassop, Tyrone, ...	Yellow Sandstone.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	St. John's Point, Dunkineely,	"
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	"
"	cylindrica, .	Castle Espie, Comber, . . .	Arenaceous Limestone.
"	filiaria, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	"	Clonea, Dungarvan, ...	"
"	"	Malahide, Malahide, ...	"
"	granulosa, .	Doorin, Donegal, ...	Yellow Sandstone.
"	"	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	"
"	"	Clonea, Dungarvan, ...	"
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	interlineata, .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Dunally, ...	Yellow Sandstone.
"	"	Currens, Castle Island, . . .	Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Poulscadden, Howth, . . .	"
"	latissima, . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Rahan's Bay, Dunkineely, .	Yellow Sandstone.
"	longisulcata, .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	"
"	papilionacea, .	Drumquin, Drumquin, . . .	Yellow Sandstone.
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Swellan, Cavan, ...	Yellow Sandstone.
"	"	Townparks, Killeshandra, . .	"
"	"	Rahan's Bay, Dunkineely, .	"
"	"	Granard, Granard, ...	Yellow Sandstone and Arenaceous Limest.

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Species.		
Orthis	papilionacea, .	Ederny, Fermanagh, ...	Yellow Sandstone.
"	"	Scraghy, Castlederg, ...	"
"	parallela, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Curragh, Ardmore, ...	"
"	"	Clonea, Dungarvan, ...	"
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Kilbride, Ballycastle, . . .	Arenaceous Limestone.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	radialis, . . .	Stridagh Point, Donegal, . .	"
"	resupinata, .	Townparks, Killeshandra, . .	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . . .	"
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	semicircularis,	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Clonea, Dungarvan, ...	Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	"
"	sulcata, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	tenuistriata ? .	Currens, Castle Island, . . .	Carboniferous Slate.
"	"	Shanbally, Cork, ...	"
Spirifera	aperturata, .	Ardoe, Ardmore, ...	"
"	"	Clonea, Dungarvan, ...	"
"	attenuata, . .	Malahide, Malahide, ...	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Ring, Enniskillen, ...	Carboniferous Slate.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Clonea, Dungarvan, ...	Carboniferous Slate.
"	"	Ballinacourty, Dungarvan, .	"
"	"	Poulscadden, Howth, . . .	"
"	bisulcata, . .	Granard, Granard, ...	Yellow Sandstone and Arenaceous Limest.
"	"	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Slieve Gallion, Magherafelt, .	Yellow Sandstone.
"	calcarata, . .	Kilbride, Ballycastle, . . .	Arenaceous Limestone.
"	"	Granard, Granard, ...	Yellow Sandstone and Arenaceous Limest.
"	"	Derrybryan, Co. Clare, . . .	Yellow Sandstone.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Dunally, ...	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	clathrata, . .	Lisnapaste, Ballintra, . . .	"
"	crispa, . . .	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Kilnamack, Clonmel, . . .	Carboniferous Slate.

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Specie.		
Spirifera	crispa,	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	disjuncta, . .	Kilnamack, Clonmel, . . .	"
"	"	Clonea Castle, Dungarvan, .	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Whiting Bay, Youghal, . .	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	"	Reendonoughan, Bantry, . .	"
"	"	Poulscadden, Howth, ...	"
"	gigantea, . .	Mohill, Mohill, ...	"
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Donegal, Donegal, ...	Yellow Sandstone.
"	grandæva, . .	Rinniskiddy, Cork, ...	Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Shanbally, Carrigaline, . . .	"
"	"	Castleogary, ...	"
"	inornata, . .	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Shanbally, Cork, ...	Carboniferous Slate.
"	megaloba, . .	Currens, Castle Island, . . .	"
"	minima, . . .	Clonkeiffy, Virginia, ...	
"	octoplicata, . .	Rahan's Bay, Dunkineely, . .	Yellow Sandstone.
"	"	Ballinacourty, Dungarvan, .	"
"	ostiolata, . .	Hookhead, Fethard, ...	Limestone of the Carboniferous Slate.
"	"	Monaghan, Monaghan, . . .	
"	"	Clonea, Dungarvan, ...	Carboniferous Slate.
"	"	Mohill, Mohill, ...	"
"	"	Horath, Moynalty, ...	Limestone of the Carboniferous Slate.
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	rhomboidea, .	Lisnapaste, Ballintra, . . .	"
"	"	Ballinacourty, Dungarvan, .	"
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	rotundata, . .	Clonea, Dungarvan, ...	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	rudis, ...	Ballinacourty, Dungarvan, .	"
"	"	Poulscadden, Howth, . . .	"
"	speciosa, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Doorin, Donegal, ...	"
"	"	Rahan's Bay, Dunkineely, .	"
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	Urii, . . .	Lisnapaste, Ballintra, . . .	"
Cyrtia	cuspidata, . .	Doorin, Donegal, ...	Yellow Sandstone.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Cyrtia	cuspidata, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Curragh, Ardmore, ...	Carboniferous Slate.
,,	,,	Newcastle, Clogheen,. . . .	,,
,,	,,	Currens, Castle Island, . . .	,,
,,	,,	Malahide, Malahide, ...	,,
,,	distans, . . .	Hook Head, Fethard,. . . .	Limestone of the Carboniferous Slate.
,,	,,	Currens, Castle Island, . . .	Carboniferous Slate.
,,	,,	Kilnamack, Clonmel, . . .	,,
,,	,,	Tinnycahill, Donegal, . . .	Yellow Sandstone and Arenaceous Limest.
,,	,,	Malahide, Malahide, ...	Carboniferous Slate.
,,	,,	Rahan's Bay, Dunkineely,. .	Yellow Sandstone.
,,	,,	Poulscadden, Howth, . . .	Carboniferous Slate.
,,	laminosa, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Ballinacourty, Dungarvan, .	Carboniferous Slate.
,,	,,	Stridagh Point, Donegal, . .	,,
,,	,,	Poulscadden, Howth, . . .	,,
,,	,,	Malahide, Malahide, ...	,,
,,	linguifera, . .	Granard, Granard, ...	Yellow Sandstone and Arenaceous Slate.
,,	mesogonia, .	Hook Head, Fethard, ...	Limestone of the Carboniferous Slate.
,,	nuda, ...	Clonea, Dungarvan, ...	Carboniferous Slate.
,,	,,	Rinniskiddy, Cork, ...	,,
,,	semicircularis,	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Mohill, Mohill, ...	Carboniferous Slate.
,,	,,	Malahide, Malahide, ...	,,
,,	simplex, . . .	,, ,, ...	,,
,,	,,	Lisnapaste, Ballintra,. . . .	,,
,,	,,	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	St. John's Point, Dunkineely,	,,
Martinia	decora, . . .	Clonea Castle, Dungarvan Bay,	Carboniferous Slate.
,,	elliptica, . .	Ballybodonnell, Dunkineely,	Yellow Sandstone.
,,	,,	Malahide, Malahide, ...	Carboniferous Slate.
,,	glabra, . . .	Clonea Castle, Dungarvan Bay,	,,
,,	phalæna, . .	St. Doolough's, Dublin, . .	,,
,,	,,	Ballinacourty, Dungarvan, .	,,
,,	,,	Clonea, Dungarvan, ...	,,
,,	plebeia, . . .	Hook Head, Fethard,. . . .	,,
,,	,,	Tullyard, Armagh, ...	Lower Limestone.
,,	,,	Lisnapaste, Ballintra, . . .	,,
,,	strigocephaloides,	,, ,, . . .	,,
Reticularia,	imbricata, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Ring, Enniskillen, ...	Carboniferous Slate.
,,	,,	Mohill, Mohill, ...	,,

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Species.		
Reticularia	imbricata, . .	Hook Head, Fethard,. . . .	Limestone of the Carboniferous Slate.
"	lineata, . . .	Doorin, Donegal, ...	Yellow Sandstone.
"	microgemma, .	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	striatella, . .	Termon, Boyle, ...	Lower Limestone.
Brachythyris	duplicicosta, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Killaghtee, Dunkineely, . .	"
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	integricosta, .	Mohill, Mohill, ...	"
"	"	Ballinacourty, Dungarvan, .	"
"	ovalis, . . .	Ballinacourty, Dungarvan, .	"
"	pinguis, . . .	Ballinacourty, Dungarvan, .	"
"	"	Hook Head, Fethard, . . .	"
"	"	Malahide, Malahide, ...	"
"	planata, . . .	St. Doulough's, Dublin, . .	Limestone of the Carboniferous Slate.
"	planicostata, .	Bruckless, Dunkineely, . .	Yellow Sandstone.
Athyris	concentrica, .	Bruckless, Dunkineely, . .	"
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Rathbale, Swords, ...	Carboniferous Slate.
"	"	Ballinacourty, Dungarvan, .	"
"	"	Poulscadden, Howth, . . .	"
"	decussata, . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Curragh, Ardmore, ...	Carboniferous Slate.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Clonea, Dungarvan, ...	Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Currens, Castle Island, . . .	"
"	"	Malahide, Malahide, ...	"
"	"	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	depressa, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Doorin, Donegal, ...	Yellow Sandstone.
"	"	Donegal, Donegal, ...	"
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	fimbriata, . .	Poulscadden, Howth, . . .	"
"	glabristria, .	Ballinacourty, Dungarvan, .	"
"	"	Mohill, Mohill, ...	"
"	"	Lough Esk, Donegal, . . .	Arenaceous Limestone.
"	"	Malahide, Malahide, . . .	Carboniferous Slate.

Name of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Athyris	globularis, . .	Clonea, Dungarvan, ...	Carboniferous Slate.
"	"	Kilbride, Ballycastle, . . .	Arenaceous Limestone.
"	hispida, . . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	planosulcata, .	Lackagh, Drumquin,. . . .	Yellow Sandstone.
"	"	Inver, Donegal.	Arenaceous Limestone.
"	squamosa, . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	triloba, ...	Drumscraw, Drumquin, . .	Yellow Sandstone.
Atrypa	angularis, . .	Ballinglen, Ballycastle, . .	Arenaceous Limestone.
"	compta, . . .	Kilcummin, Killala Bay, . .	Carboniferous Slate.
"	desquamata, .	Clonea Castle, Dungarvan Bay	"
"	"	Ballinacourty, Dungarvan Bay	"
"	fallax, . . .	Ardoe, Ardmore, ...	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Kilnamack, Clonmel, . . .	Carboniferous Slate.
"	"	Currens, Castle Island, . . .	"
"	"	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	"	Fivemiletown, Fivemiletown,	"
"	flexistria, . .	St. Doolough's, Dublin, . .	Limestone of the Carboniferous Slate.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	gregaria, . .	Kilbride, Ballycastle, . . .	Arenaceous Limestone.
"	hastata, . . .	Bruckless, Dunkineely, . .	Yellow Sandstone.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	"
"	indentata, . .	Larganmore, Bangor, . . .	Yellow Sandstone.
"	insperata, . .	Clonea, Dungarvan, . . .	Carboniferous Slate.
"	"	Ballinacourty, Dungarvan, .	"
"	juvenis, . . .	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . .	"
"	lachryma, . .	Malahide, Malahide, ...	Carboniferous Slate.
"	laticosta, . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	nana, ...	Rahoran, Fivemiletown, . .	"
"	oblonga ? . .	Clonea, Dungarvan, ...	"
"	pleurodon, . .	Cregganore, Gort, ...	Yellow Sandstone.
"	"	Bruckless, Dunkineely, . . .	"
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	prisca, . . .	Shanbally, Carrigaline, . . .	"
"	proava, . . .	Malahide, Malahide, ...	"
"	pugnus, . . .	St. Doolough's, Dublin, . .	Limestone of the Carboniferous Slate.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Atrypa	pugnus, . . .	Inver, Donegal, ...	Arenaceous Limestone.
"	radialis, . . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Cregganore, Gort, ...	"
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	reniformis, . .	Lisnapaste, Ballintra, . . .	"
"	sacculus, . . .	Granard, Granard, ...	Yellow Sandstone and Arenaceous Limestone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	striatula, . .	Clonea, Dungarvan, ...	"
"	"	Rinniskiddy, Cork, ...	"
"	"	Curragh, Ardmore, ...	"
"	"	Ballinacourty, Dungarvan, .	"
"	sulcirostris, .	Carnly, Sligo, ...	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	triplex, . . .	Kildress, Cookstown, ...	"
"	ventilabrum, .	Malahide, Malahide, ...	Carboniferous Slate.
"	virgo, ...	Larganmore, Bangor, . . .	Yellow Sandstone.
CRUSTACEA.			
Calymene	granulata ? . .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	lævis, ...	Clonea, Dungarvan, ...	"
"	Latreillii, . .	Clonea, Dungarvan, ...	"
Griffithides	obsoletus, . .	Kilbride, Ballycastle, . . .	Arenaceous Limestone.
Phillipsia	Colei, ...	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	gemmulifera, .	Poulscadden, Howth, . . .	"
"	"	Kilbride, Ballycastle, . . .	Arenaceous Limestone.
"	truncatula, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Currens, Castle Island. . . .	Carboniferous Slate.
Dithyrocaris	Colei, ...	Aghnaglogh, Clogher, . . .	"
"	Scouleri, . . .	Aghnaglogh, Clogher, . . .	"
Bairdia	curtus, . . .	Granard, Granard, ...	Carboniferous Slate and Arenaceous Limest.
Cythere	arcuata, . . .	Dromard, Draperstown, . . .	Yellow Sandstone.
"	bituberculata, .	Cultra, Hollywood, ...	"
"	cornuta, . . .	Cultra, Hollywood, ...	"
"	costata, . . .	Cultra, Hollywood, ...	"
"	elongata, . .	Cultra, Hollywood, ...	"
"	excavata, . .	Aghnaglogh, Clogher, . . .	Carboniferous Slate.
"	Hibbertii, . .	Larganmore, Bangor, . . .	Yellow Sandstone.
"	impressa, . .	Dromard, Draperstown, . . .	"
"	inornata, . .	Cultra, Hollywood, ...	"
"	oblonga, . . .	Cullion, Draperstown, . . .	"
"	orbicularis, . .	Bunowna, Easky, ...	"
"	pusilla, . . .	Cullion, Draperstown, . . .	"
"	subrecta, . . .	Larganmore, Bangor, . . .	"
"	trituberculata,	Cultra, Hollywood, ...	"

Names of Fossils.		Localities and Post Towns.	Subdivision.
Genera.	Species.		
ANNELIDA.			
Serpula	scalaris, . . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
Spirorbis	caperatus, . .	Hook Head, Fethard, . . .	,,
,,	globosus, . .	Aghnaglogh, Clogher, . . .	,,
,,	intermedius, .	Cultra, Hollywood, ...	Yellow Sandstone.
,,	minutus,. . .	Aghnaglogh, Clogher, . . .	Carboniferous Slate.
,,	omphalodes? .	Cultra, Hollywood, ...	Yellow Sandstone.
Spiroglyphus	marginatus, .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
Serpulites	membranaceus	St. Doolough's, Dublin,. . .	,,
ECHINODERMATA.			
Palæchinus	elegans, . . .	Hook Head, Fethard, · . .	Limestone of the Carboniferous Slate.
,,	gigas, ...	Hook Head, Fethard, . . .	,,
,,	,,	Rahan's Bay, Dunkineely, .	Yellow Sandstone.
,,	Königii, . . .	Rahan's Bay, Dunkineely, .	,,
Echinocrinus	elegans, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	glabrispina, .	Hook Head, Fethard, . . .	,,
,,	,,	Clonea, Dungarvan, ...	Carboniferous Slate.
,,	triserialis, . .	Killycloghy, Lisbellaw,. . .	
,,	Urii, ...	Townparks, Killeshandra,. .	Yellow Sandstone.
,,	,,	Lough Esk, Donegal,. . . .	Arenaceous Shale.
,,	,,	Rahan's Bay, Dunkineely,. .	Carboniferous Slate.
,,	,,	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
,,	,,	Malahide, Malahide, ...	Carboniferous Slate.
,,	vetustus, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
Adelocrinus	histrix, . . .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
Platycrinus	contractus,. .	Cregganore, Gort, ...	Yellow Sandstone.
,,	gigas, ...	Malahide, Malahide, ...	Carboniferous Slate.
,,	granulatus, .	Ballinacourty, Dungarvan, .	,,
,,	interscapularis,	Ballinacourty, Dungarvan, .	,,
,,	,,	Poulscadden, Howth,. . . .	,,
,,	laciniatus, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	lævis, ...	Hook Head, Fethard, . . .	,,
,,	ornatus, . . .	Hook Head, Fethard, . . .	,,
,,	punctatus, . .	St. John's Point, Dunkineely,	,,
,,	similis, . . .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
,,	triacontadactylus,. . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
Platycrinus	tuberculatus, .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
Poteriocrinus	gracilis, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
Taxocrinus	macrodactylus,	Clonea, Dungarvan, ...	Carboniferous Slate.
,,	,,	Ballinacourty, Dungarvan, .	,,
Cyathocrinus	ellipticus, . .	Ballinacourty, Dungarvan .	,,

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Cyathocrinus	ellipticus, .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	,,	Poulscadden, Howth, . . .	,,
,,	geometricus, .	Currens, Castle Island, . . .	,,
,,	,,	Curragh, Ardmore, ...	,,
,,	,,	Ballinacourty, Dungarvan, .	,,
,,	inæquidactylus	Malahide, Malahide, ...	,,
,,	macrocheirus, .	Rahan's Bay, Dunkineely, .	Yellow Sandstone.
,,	megastylus, .	St. Doolough's, Dublin, . . .	Limestone of the Carboniferous Slate.
,,	,,	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
,,	,,	Mohill, Mohill, ...	,,
,,	ornatus, . . .	Malahide, Malahide, ...	,,
,,	pinnatus?	Lisnapaste, Ballintra, . . .	,,
,,	,,	Clonea, Dungarvan, ...	,,
,,	,,	St. Doolough's Dublin, . . .	Limestone of the Carboniferous Slate.
,,	,,	Ballinacourty, Dungarvan, .	Carboniferous Slate.
,,	tuberculatus, .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	variabilis, . .	Ballinacourty, Dungarvan, .	Carboniferous Slate.
,,	,,	Currens, Castle Island, . . .	,,
,,	,,	Knocklofty, Co. Tipperary, .	,,
,,	,,	Clonea, Dungarvan, ...	,,
,,	,,	Malahide, Malahide, ...	,,
,,	,,	Bruckless, Dunkineely, . . .	Yellow Sandstone.
Rhodocrinus	verus, ...	Poulscadden, Howth, ...	Carboniferous Slate.
Actinocrinus	Gilbertsoni, .	Malahide, Malahide, ...	,,
,,	polydactylus, .	Ballinacourty, Dungarvan, .	,,
,,	pusillus, . . .	Malahide, Malahide, ...	,,
,,	tenuistriatus, .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
,,	,,	Rahan's Bay, Dunkineely, .	,,
,,	,,	Ardoe, Ardmore, ...	Carboniferous Slate.
,,	,,	Clonea, Dungarvan, ...	,,
,,	,,	Lisnapaste, Ballintra, . . .	,,
,,	tesselatus, . .	Clonea, Dungarvan, ...	,,
,,	triacontadactylus, ...	Ballinacourty, Dungarvan, .	,,
,,	,,	Malahide, Malahide, ...	,,
Atocrinus	Milleri, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
ZOOPHYTA.			
Amplexus	nodulosus, . .	Clonea Castle, Dungarvan, .	Carboniferous Slate.
,,	,,	Ballinacourty, Dungarvan, .	,,
,,	Sowerbii, . .	Ballinacourty, Dungarvan, .	,,
,,	,,	Clonea, Dungarvan, ...	,,
,,	,,	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Malahide, Malahide, ...	Carboniferous Slate.
,,	tortuosus, . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Clonea Castle, Dungarvan Bay,	Carboniferous Slate.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Turbinolopsis	bina?	Bruckless, Dunkineely, . . .	Yellow Sandstone.
,,	,,	Currens, Castle Island, . . .	Carboniferous Slate.
,,	Celtica, . . .	Ballinacourty, Dungarvan, .	,,
,,	,,	Knocklofty, Co. Tipperary, .	,,
,,	,,	Clonea Castle, Dungarvan Bay,	,,
,,	pauciradialis, .	Currens, Castle Island, . . .	,,
,,	,,	Ballinacourty, Dungarvan, .	,,
,,	pluriradialis, .	Currens, Castle Island, . . .	,,
Turbinolia	fungites, . . .	Kilbride, Ballycastle, ...	Arenaceous Limestone.
,,	,,	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Bruckless, Dunkineely, . . .	Yellow Sandstone.
,,	,,	Slieve Gallion, Magherafelt, .	,,
,,	,,	Lisnapaste, Ballintra, . . .	,,
,,	,,	Poulscadden, Howth, ...	Carboniferous Slate.
,,	,,	Ballybodonnell, Dunkineely, .	Yellow Sandstone.
,,	,,	Malahide, Malahide, ...	Carboniferous Slate.
Siphonophyllia	cylindrica, . .	Lackagh, Drumquin, ...	Yellow Sandstone.
,,	,,	Ardsallagh, Drumquin, . . .	Carboniferous Slate.
,,	,,	Scraghy, Castlederg, ...	,,
,,	,,	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Poulscadden, Howth, ...	Carboniferous Slate.
Astræa	irregularis, . .	Bunowna, Easky, ...	,,
,,	pentagona, . .	Larganmore, Bangor, . . .	Yellow Sandstone.
Lithodendron	affine, ...	Lackagh, Drumquin, ...	,,
,,	cæspitosum, .	Scraghy, Castlederg, ...	,,
,,	sexdecimale, .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
,,	,,	Poulscadden, Howth, ...	Carboniferous Slate.
,,	,,	St. John's Point, Dunkineely,	Yellow Sandstone.
Syringopora	bifurcata, . .	Poulscadden, Howth, ...	Carboniferous Slate.
,,	catenata, . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
,,	geniculata, . .	Drumscraw, Drumquin, . . .	Yellow Sandstone.
,,	,,	Tinnycahill, Donegal, . . .	Yellow Sandstone and Arenaceus Limest.
,,	,,	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
,,	,,	Malahide, Malahide, ...	Carboniferous Slate.
,,	laxa, ...	Bruckless, Dunkineely, . . .	Yellow Sandstone.
,,	ramulosa, . .	Rahan's Bay, Dunkineely, .	,,
,,	,,	Malahide, Malahide, ...	Carboniferous Slate.
,,	,,	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
Aulopora	campanulata, .	Hook Head, Fethard, . . .	,,
Manon	cribrosum ?. .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
,,	,,	Clonea, Dungarvan, ...	Carboniferous Slate.
,,	,,	Ballinacourty, Dungarvan, .	,,
Astreopora	antiqua, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.	Subdivision.
Dictyophyllia	antiqua, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
Pleurodictyum	problematicum?	Ballinacourty, Dungarvan, .	Carboniferous Slate.
"	"	Clonea, Dungarvan, ...	"
"	"	Lisnapaste, Ballintra, . . .	"
Favosites,	fibrosa, . . .	Clonea, Dungarvan, ...	"
"	"	Curragh, Ardmore, ...	"
"	megastoma? .	Meenacarrigby, Drumquin, .	Yellow Sandstone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
"	"	Scraghy, Drumquin, ...	"
"	"	Poulscadden, Howth, . . .	"
"	polymorpha, .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	serialis, . . .	Malahide, Malahide, ...	Carboniferous Slate.
"	spongites, . .	Poulscadden, Howth, . . .	"
"	"	Swellan, Cavan, ...	"
"	"	Malahide, Malahide, ...	"
"	tenuisepta, . .	Lackagh, Drumquin, ...	Yellow Sandstone.
"	"	Mohill, Mohill, ...	Carboniferous Slate.
"	"	Poulscadden, Howth, ...	"
"	tumida, . . .	Lackagh, Drumquin, ...	Yellow Sandstone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
Stromatopora	concentrica, .	Killybrone, Killala, ...	Arenaceous Limestone.
"	"	Malahide, Malahide, ...	Carboniferous Slate.
Verticillipora	abnormis? . .	Ballinacourty, Dungarvan, .	"
"	"	Malahide, Malahide, ...	"
"	"	Clonea, Dungarvan, ...	"
"	"	Poulscadden, Howth, ...	"
"	"	Ballinacourty Pt., Dungarvan, ...	"
Berenicea	megastoma, .	See with Spirorbis caperatus, .	"
Orbiculites	antiquus, . .	Rahoran, Fivemiletown, . .	"
Millepora	gracilis, . . .	Clonea, Dungarvan, ...	"
"	"	Lisnapaste, Ballintra, . . .	"
"	"	Ballinacourty, Dungarvan, .	"
"	interporosa, .	Malahide, Malahide, ...	"
"	"	Mohill, Mohill, ...	"
"	"	Lisnapaste, Ballintra, ...	Yellow Sandstone.
"	oculata, . . .	Cregganore, Gort, ...	Carboniferous Slate.
"	"	Poulscadden, Howth, ...	"
"	rhombifera, .	Lisnapaste, Ballintra, . . .	"
"	"	Poulscadden, Howth, . . .	Yellow Sandstone.
"	similis, . . .	Cregganore, Gort, ...	Limestone of the Carboniferous Slate.
"	"	St. Doolough's, Dublin, . .	Carboniferous Slate.
"	spicularis, . .	Poulscadden, Howth, . . .	"
Gorgonia	assimilis, . .	Ballinacourty, Dungarvan, .	Yellow Sandstone and
"	zic-zac, . . .	Granard, Granard, ...	Arenaceous Limestone.

Names of Fossils.		Localities and Post-Towns.	Subdivision.
Genera.	Species.		
Jania	antiqua, . . .	St. John's Point, Dunkineely,	Carboniferous Slate.
"	bacillaria, . .	Lisnapaste, Ballintra, . . .	"
"	crassa, . . .	St. John's Point, Dunkineely,	Limestone of the Carboniferous Slate.
"	"	Lackagh, Drumquin,. . . .	Yellow Sandstone.
Vincularia	parallela, . .	Mohill, Mohill, ...	Carboniferous Slate.
Glauconome	bipinnata, . .	Ballinacourty, Dungarvan, .	"
"	"	Poulscadden, Howth,. . . .	"
"	pluma, . . .	Lisnapaste, Ballintra, . . .	"
"	"	Ballinacourty, Dungarvan, .	"
"	"	Poulscadden, Howth, . . .	"
"	"	Lackagh, Drumquin,. . . .	Yellow Sandstone.
Ptylopora	macropora,. .	Poulscadden, Howth, . . .	Carboniferous Slate.
"	pluma, . . .	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
"	"	Poulscadden, Howth, . . .	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
Fenestella	antiqua, . . .	Currens, Castle Island, . . .	"
"	"	Gurteenroe, Bantry, ...	"
"	"	Killingley, ...	"
"	"	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Blackball Head, Cork, . . .	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	carinata,. . .	Enagh, Tynan, ...	"
"	"	Malahide, Malahide, ...	"
"	flabellata, . .	Bruckless, Dunkineely, . . .	Yellow Sandstone
"	formosa, . . .	Currens, Castle Island, . . .	Carboniferous Slate
"	"	Malahide, Malahide, ...	"
"	laxa, ...	Clonea Castle, Dungarvan, .	"
"	multiporata, .	Brickeen Bridge, Killarney, .	Yellow Sandstone.
"	nodulosa, . .	Poulscadden, Howth, . . .	Carboniferous Slate.
"	oculata, . . .	Ballinacourty, Dungarvan, .	"
"	plebeia, . . .	Killybrone, Killala, ...	Arenaceous Limestone.
"	regularis, . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	reticularis, . .	Currens, Castle Island, . . .	"
"	spongites, . .	Poulscadden, Howth, . . .	"
"	tenuifila,. . .	Kilnamack, Clonmel,. . . .	"
"	"	Greaghs, Ballintra, ...	"
"	"	Bruckless, Dunkineely,. . .	Yellow Sandstone.
"	"	Poulscadden, Howth,. . . .	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	undulata, . .	Bruckless, Dunkineely, . . .	Yellow Sandstone.
"	"	Kilbride, Ballycastle,. . . .	Arenaceous Limestone.
"	"	Greaghs, Ballintra, ...	Carboniferous Slate.
"	"	Malahide, Malahide, ...	"
"	"	Poulscadden, Howth, . . .	"
Polypora	dendroides, .	Townparks, Killeshandra, . .	Yellow Sandstone.
"	"	Hook Head, Fethard, . . .	Limestone of the Carboniferous Slate.
Retepora	undata, . . .	Lisnapaste, Ballintra, . . .	Carboniferous Slate.
"	"	Mohill, Mohill, ...	"

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.	Subdivision.
PLANTS.			
LOWER CARBONIFEROUS PLANTS.			
Sternbergia	approximata,	Cultra, Hollywood, ...	Yellow Sandstone.
,,	,,	Golin, Cavan, ...	,,
Sphenopteris	linearis, . .	Riv. Banagh, Drumcurren, Kesh, ...	,,
Fucoids and	Ferns, . . .	Bunatrahir, Ballycastle, . .	,,
Ferns and	Fucoids, . .	Kilcummin, Killala Bay, . .	Carboniferous Slate.
Ferns	,,	Dromard, Draperstown, . .	Yellow Sandstone.
,,	,,	Fallagloon, Maghera, . . .	,,
Stigmaria	ficoides, . . .	Mac Swyne's Bay, Dunkineely, and North coast of Mayo, .	,,
Sigillaria and	Dictyophyllum	Do., do.	,,
,,	Ferns, . . .	Cork, Cork, ...	,,
,,	,,	Blackball Head, Castletown,	,,
,,	,,	Drummanmore, Armagh, . .	,,
,,	,,	Camphire, Vale of the Bride,	Yellow Sandstone.
,,	,,	Janeville, Vale of the Bride, .	,,
,,	,,	Bruckless Chapel, Dunkineely,	,,
,,	,,	Bruckless, Dunkineely, . . .	,,
,,	,,	Aighan Bridge, Dunkineely,	,,
,,	,,	Brickeen Bridge, Killarney .	,,
,,	,,	Clontarf, Dublin, ...	Carboniferous Slate.
,,	,,	Bleankillew, Drumod, . . .	,,
,,	,,	Cultra, Hollywood, ...	Yellow Sandstone.
Cyclostigma	,,	Kiltorcan, Ballyhale, . . .	,,
Sphenopteris	Hibernica, .	,, ,,	,,
,,	,,	Tallow Bridge, ...	,,
Lepidodendron	Griffithii, . .	,, ,,	,,
,,	new, ...	Drumconny, Cloone, ...	Carboniferous Slate.

SECTION II.—DIVISION I.

The first member of the Second, or Limestone Group of the Series, is the Lower Carboniferous Limestone.

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.
MOLLUSCA.		
CEPHALOPODA.		
ORTHOCERATIDÆ.		
Orthoceras	attenuatum, ...	Rathgillen, Nobber.
,,	cinctum, ...	,,
,,	cylindraceum, ...	Ballinacourty, Dungarvan.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Orthoceras	cylindraceum, ...	Curkeen, Rush.
”	”	Tankardstown, Kildorrery.
”	”	Ratheline, Lanesborough.
”	ovale, ...	Rathgillen, Nobber.
”	”	Ardclogh, Kildare.
”	”	Ballinacourty, Dungarvan.
”	”	Annagh, Charleville.
”	pyramidale, ...	Millicent, Clane.
”	striatum, ...	Little Island, Cork.
”	”	Middleton, Cork.
Loxoceras	Breynii, ...	Millicent, Clane.
”	”	Little Island, Cork.
”	distans, ...	Kilmallock.
”	laterale, ...	Little Island, Cork.
”	”	”
”	”	Ardclogh, Rathcoole.
”	”	Millicent, Clane.
”	”	Carrigahorrig, Portumna.
”	”	Tirlecken, Ballymahon.
”	”	Ballinacourty, Dungarvan.
”	”	Cregg, Nobber.
Campyloceras	unguis, ...	Little Island, Cork.
Cycloceras	lævigatum, ...	Shrule, Ballymahon.
Poterioceras	fusiforme, ...	Millicent, Clane.
”	ventricosum, ...	”
Actinoceras	giganteum, ...	”
Cyrtoceras	tuberculatum, ...	Cork, Cork.
	NAUTILIDÆ.	
Goniatites	discus, ...	Cork, Cork.
”	excavatus, ...	Ballyduff, Dungarvan.
”	fasciculatus, ...	Millicent, Clane.
”	intercostalis, ...	Killyrean Upper, Emyvale.
”	latus, ...	Millicent, Clane.
”	Listeri, ...	Portumna, Galway.
”	”	Millicent, Clane.
”	”	Ballyduff, Dungarvan.
”	”	Howth, Howth.
”	”	Castlecree, Cork.
”	micronotus, ...	Ballinacourty, Dungarvan.
”	mutabilis, ...	Cregg, Nobber.
”	obtusus, ...	Ballyduff, Dungarvan.
”	”	Cork, Cork.
”	”	Millicent, Clane.
”	”	Cregg, Nobber.
”	ovatus, ...	Little Island, Cork.
”	”	Ballyduff, Dungarvan.
”	sphæroidalis, ...	” ”
”	”	Nenagh, Tipperary.
”	”	Kilmallock.
”	striolatus, ...	Mullawornia, Ballymahon.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Goniatites	truncatus, ...	Tankardstown, Kildorrery.
Discites	costellatus, ...	Millicent, Clane.
"	discors, ...	"
"	"	Blackrock, Cork.
"	latidorsatus, ...	Millicent, Clane.
"	planotergatus, ...	Cork, Cork.
"	subsulcatus, ...	Little Island, Cork.
"	"	Millicent, Clane.
"	sulcatus, ...	Little Island, Cork.
"	trochlea, ...	Cookstown, Cookstown.
Temnocheilus	biangulatus, ...	Ballinacourty, Dungarvan.
"	"	Middleton, Cork.
"	"	Tirlecken, Ballymahon.
"	"	Laracor, Trim.
"	"	Millicent, Clane.
"	cariniferus, ...	"
"	"	Tirlecken, Ballymahon.
"	"	Ardclogh, Kildare.
"	coronatus, ...	Little Island, Cork.
"	costalis, ...	Millicent, Clane.
"	crenatus, ...	Tirlecken, Shrule.
"	furcatus, ...	Castle Richard, Middleton.
"	multicarinatus, ...	Millicent, Clane.
"	"	Tankardstown, Kildorrery.
"	"	Tirlecken, Ballymahon.
"	"	Arclogh, Rathcoole.
"	"	Little Island, Cork.
"	"	Longford, Longford.
"	pinguis, ...	Kilmallock, Limerick.
"	"	Ballyduff, Dungarvan.
"	sulciferus, ...	Millicent, Clane.
"	"	Ballyduff, Dungarvan.
"	"	Ardclogh, Rathcoole.
"	tuberculatus, ...	Dungarvan, Waterford.
Nautilus	cyclostomus, ...	Little Island, Cork.
"	"	Middleton, Middleton
"	"	Ballybeg, Buttevant
"	dorsalis, ...	Little Island, Cork.
"	"	Kilcommock, Longford.
"	"	Millicent, Clane.
Bellerophon	apertus,	Ballyduff, Dungarvan.
"	"	Kiltullagh, Roscommon.
"	"	Annaghugh, Armagh.
"	"	Tankardstown, Kildorrery.
"	"	Carlingford, Carlingford.
"	"	Armagh, Armagh.
"	"	Drummanmore, Armagh.
"	"	Ardagh, Drumcondra.
"	cornu-arietis, ...	New Road, Armagh.
"	costatus, ...	Cookstown, Cookstown.
"	"	Carlingford, Carlingford.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Bellerophon	lævis, ...	Millicent, Clane.
,,	obsoletus, ...	Millicent, Clane.
,,	tangentialis, ...	Tirlecken, Ballymahon.
,,	,,	Carlingford, Carlingford.
,,	,,	Ardagh, Drumcondra.
,,	tenuifascia, ...	Curkeen, Rush.
,,	,,	Ardagh, Drumcondra.
,,	,,	Millicent, Clane.
Euphemus	intersectus, ...	*Incerti loci.*
,,	Urii, . . .	Cookstown, Tyrone.
,,	,,	Cregg, Nobber.
	GASTEROPODA.	
	PECTINIBRANCHIATA.	
Macrocheilus	acutus, ...	Laracor, Trim.
,,	,,	Millicent, Clane.
,,	curvilineus, ...	Millicent, Clane.
,,	imbricatus, ...	Millicent, Clane.
,,	parallelus, ...	Armagh, Armagh.
,,	rectilineus, ...	Little Island, Cork.
,,	,,	Drumlattery, Skerries.
Loxonema	brevis, ...	Toberory, Tulsk.
,,	constricta, ...	Rathmoyle House, Roscommon.
,,	,,	Millicent, Clane.
,,	impendens, ...	Chicken Hill, Kilmallock.
,,	polygyra, ...	Curkeen, Rush.
,,	sulculosa, ...	Millicent, Clane.
,,	,,	Tankardstown, Kildorrery.
,,	tumida, ...	Tirlecken, Ballymahon.
Turritella	megaspira, ...	Millicent, Clane.
,,	suturalis, ...	Carrigahorrig, Portumna.
,,	,,	Cookstown, Tyrone.
,,	,,	Horath, Moynalty.
,,	teniustria, ...	Oldtown, Dublin.
,,	,,	Tymore Todd, Augher.
,,	,,	Laracor, Trim.
,,	,,	Tirlecken, Ballymahon.
Naticopsis	canaliculata, ...	Ring, Enniskillen.
,,	dubia, ...	Carrigaline, Cork.
,,	elongata, ...	Millicent, Clane.
,,	,,	Kilmore, Armagh.
,,	,,	Kiltullagh, Roscommon.
,,	Neritoides, ...	Tullyoran, Mohill.
,,	Phillipsii, ...	Kilcommock, Longford.
,,	,,	Ardclogh, Rathcoole.
,,	,,	Ballyduff, Dungarvan.
,,	,,	Ballinacourty, Dungarvan.
,,	,,	Millicent, Clane.
,,	,,	Lane, Skerries.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Naticopsis	plicistria, ...	Armagh, Armagh.
"	"	Cookstown, Tyrone.
"	"	College Hall, Tynan.
Euomphalus	acutus, ...	Millicent, Clane.
"	"	Howth, Howth.
"	"	Ballykea, Skerries.
"	"	Little Island, Cork.
"	"	Ardagh, Drumcondra.
"	æqualis, ...	Curkeen, Rush.
"	"	Ballykea, Skerries.
"	anguis, ...	Chicken Hill, Kilmallock.
"	calyx, ...	Millicent, Clane.
"	"	Tankardstown, Kildorrery.
"	cristatus, ...	Strokestown, Roscommon.
"	crotalostomus, ...	Carrickreagh, Enniskillen.
"	"	Rathmoyle House.
"	"	Drum, Ederny.
"	neglectus, ...	Millicent, Clane.
"	pentangulatus, ...	Millicent, Clane.
"	"	Tirlecken, Ballymahon.
"	"	Little Island, Cork.
"	"	Carrigahorrig, Portumna.
"	"	Ballykea, Skerries.
"	"	Tankardstown, Kildorrery.
"	"	Ardclogh.
"	"	Ardclogh, Rathcoole.
"	"	Millicent, Clane.
"	pileopsideus, ...	Ardagh, Drumcondra.
"	"	Howth, Howth.
"	rotundatus, ...	Cookstown, Cookstown.
"	"	New Road, Armagh.
"	"	Ardagh, Drumcondra.
"	"	Mullaghfin, Duleek.
"	"	Little Island, Cork.
"	tabulatus, ...	Moymore, Tulla.
"	"	Little Island, Cork.
"	"	Mulnahunch, Dungannon.
"	"	Tirlecken, Shrule.
Platyschisma	Cirroides, ...	College Hall, Tynan.
"	Helicoides, ...	Cookstown, Cookstown.
"	"	Curkeen, Rush.
"	"	Millicent, Clane.
"	Jamesii, ...	Donaghrisk, Cookstown.
"	zonites, ...	Cork.
Pleurotomaria	carinata, ...	Cookstown, Tyrone.
"	concentrica, ...	Clare, Cookstown.
"	"	Milverton, Skerries.
"	decussata, ...	Millicent, Clane.
"	filosa, ...	Millicent, Clane.
"	Griffithii, ...	Ardclogh, Rathcoole.
"	"	Millicent, Clane.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Pleurotomaria	Hainesii, ...	Little Island, Cork.
"	lenticula, ...	Little Island, Cork.
"	multicarinata, ...	Millicent, Clane.
Elenchus	subulatus, ...	Armagh, Armagh.
SCUTIBRANCHIATA AND CYCLOBRANCHIATA.		
Trochella	prisca, ...	Millicent, Clane.
Acroculia	angustata, ...	Clare, Cookstown.
"	canaliculata, ...	Toberory, Tulsk.
"	carinata,.	Millicent, Clane.
"	triloba, ...	Kilmallock.
"	tubifer, ...	Hook Head, Fethard.
"	vetusta, ...	Little Island, Cork.
"	"	Millicent, Clane.
Patella	mucronata,.	Cookstown, Tyrone.
"	scutiformis, ...	New Canal, Tralee.
"	sinuosa, ...	Millicent, Clane.
Siphonaria	Konincki, ...	Ballymacelligut, Tralee.
Umbrella	lævigata, ...	Millicent, Clane.
Dentalium	inornatum,.	Cookstown, Cookstown.
DITHYRA.		
MACROTRACHIA.		
Sanguinolites	arcuatus, ...	Millicent, Clane.
"	contortus, ...	Kilmallock.
"	sulcatus,.	Drummanmore, Armagh.
"	"	Cookstown.
"	tumidus, ...	Millicent, Clane.
"	"	Armagh, Armagh.
Edmondia ?	compressa, ...	Cork.
Lutraria	prisca, ...	Millicent, Clane.
Mactra	incrassata, ...	Kilmallock.
Psammobia	decussata, ...	Little Island, Cork.
Amphidesma	subtruncatum, ...	Millicent, Clane.
Corbis	cancellata, ...	Carrigaline, Cork.
Cyprina	Egertoni, ...	Millicent, Clane.
"	"	Kilmallock.
Donax	primigenius, ...	Cookstown, Cookstown.
Cardium	orbiculare, ...	Little Island, Cork.
"	"	Leek, Monaghan.
Cardiomorpha	axiniformis, ...	Millicent, Clane.
"	corrugata, ...	Millicent, Clane.
"	oblonga,.	Moore, Roscommon.
"	"	Little Island, Cork.
"	"	Millicent, Clane.
"	ventricosa, ...	Cork.
Pleurorhynchus	Hibernicus, ...	Millicent, Clane.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Pleurorhynchus	Hibernicus, ...	Middleton, Cork.
,,	,,	Tankardstown, Kildorrery.
,,	,,	Castle Island, Castle Island.
,,	inflatus, ...	Carrickboy, Longford.
,,	minax, ...	Ballykea, Skerries.
,,	,,	Millicent, Clane.
,,	,,	Ballyduff, Dungarvan.
,,	trigonalis, ...	Clonturk, Carrickmacross.
Cypricardia	cuneata, ...	Balsitric, Nobber.
,,	cylindrica, ...	Millicent, Clane.
Leptodomus	fragilis, ...	*Incerti loci.*
,,	senilis, ...	Millicent, Clane.
,,	,,	Ardagh, Drumcondra.
Venerupis	cingulatus, ...	Howth, Howth.
,,	obsoletus, ...	Millicent, Clane.
,,	scalaris, ...	Millicent, Clane.
	ATRACHIA.	
Nucula	rectangularis, ...	Cookstown, Cookstown.
Arca	fimbriata, ...	Ballyduff, Dungarvan.
Cucullæa	arguta, ...	Bantyre, Cork.
,,	tenuistria, ...	Cregg, Nobber.
,,	,,	Rathgillen, Nobber.
Byssoarca	obtusa, ...	Millicent, Clane.
,,	reticulata, ...	Millicent, Clane.
Modiola	patula, ...	Blackrock, Cork.
Lithodomus	dactyloides, ...	Millicent, Clane.
Mytilus	Flemingi, ...	Millicent, Clane.
Inoceramus	lævissimus, ...	Cork, Cork.
,,	orbicularis, ...	Millicent, Clane.
,,	pernoides, ...	Millicent, Clane.
,,	vetustus, ...	Ardagh, Drumcondra.
Meleagrina	lævigata, ...	Ardagh, Drumcondra.
,,	,,	Millicent, Clane.
,,	,,	Curkeen, Rush.
,,	,,	Howth, Howth.
,,	pulchella, ...	Millicent, Clane.
,,	quadrata, ...	Millicent, Clane.
,,	radiata, ...	Ardagh, Drumcondra.
Pteronites	latus, ...	Millicent, Clane.
Avicula	lævigata, ...	Millicent, Clane.
,,	laminosa,*	Millicent, Clane.
,,	,,	Howth, Howth.
,,	,,	Ardagh, Drumcondra.
,,	lunulata, ...	Howth, Howth.
,,	,,	Salmon, Balbriggan.
,,	,,	Millicent, Clane.
,,	recta, ...	Millicent, Clane.
Pinna	flabelliformis, ...	Cookstown, Cookstown.
Anomia	antiqua, ...	Poulscadden, Howth.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Lima	alternata, ...	Ardagh, Drumcondra.
"	lævigata, ...	Millicent, Clane.
"	prisca, ...	Ardagh, Drumcondra.
Pecten	arenosus, ...	Millicent, Clane.
"	"	Howth, Howth.
"	clathratus, ...	Little Island, Cork.
"	cœlatus, ...	Red Barn, Armagh.
"	"	Cookstown, Tyrone.
"	concentrico-striatus, . .	Millicent, Clane.
"	"	Howth, Dublin.
"	deornatus, ...	Little Island, Cork.
"	dissimilis, ...	Millicent, Clane.
"	"	Ballyduff, Dungarvan.
"	ellipticus, ...	Ballyduff, Dungarvan.
"	"	Millicent, Clane.
"	"	Little Island, Cork.
"	"	Tullyard, Armagh.
"	"	Howth, Dublin.
"	elongatus, ...	Millicent, Clane.
"	fallax, ...	Kilmore, Cavan.
"	"	Millicent, Clane.
"	"	Little Island, Cork.
"	"	Ballyduff, Dungarvan.
"	filatus, ...	Millicent, Clane.
"	flexuosus, ...	New Road, Armagh.
"	"	Tonyshanderry, Emyvale.
"	Forbesii,.	Millicent, Clane.
"	gibbosus, ...	Ballyduff, Dungarvan.
"	"	Howth.
"	granosus, ...	Millicent, Clane.
"	"	Little Island, Cork.
"	"	Howth, Dublin.
"	hians,.	Millicent, Clane.
"	intercostatus,.	Little Island, Cork.
"	mundus,.	Flemingstown, Balbriggan.
"	Murchisoni, ...	Tankardstown, Kildorrery.
"	"	Cregg, Nobber.
"	ovatus, ...	Ardagh, Drumcondra.
"	planicostatus, ...	Little Island, Cork.
"	plicatus, ...	Ballyduff, Dungarvan.
"	"	Mullawornia, Ballymahon.
"	Sedgwickii, ...	Little Island, Cork.
"	semistriatus, ...	Little Island, Cork.
"	"	Ardagh, Drumcondra.
"	Sowerbii, ...	Howth, Howth.
"	"	Millicent, Clane.
"	"	Ballyduff, Dungarvan.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
	BRACHIOPODA.	
	ATHYRIDÆ.	
Crania	vesiculosa,	Millicent, Clane.
Calceola	sandalina,	Ballyduff, Dungarvan.
Producta	aculeata,	Howth, Howth.
"	"	Mullawornia, Ballymahon.
"	antiquata,	Hook Head, Fethard.
"	"	Ardclogh, Rathcoole.
"	"	Millicent, Clane.
"	"	Cornacarrow, Enniskillen.
"	aurita,	Donaghrisk, Cookstown.
"	"	Cookstown, Tyrone.
"	concinna,	Little Island, Cork.
"	"	Boston, Rathangan.
"	"	Cookstown, Tyrone.
"	"	Tullyoran, Mohill.
"	"	Boyle, Roscommon.
"	corrugata,	Salmon, Man-of-War, Balbriggan.
"	"	Milverton, Skerries.
"	"	Kiltullagh, Castlereagh.
"	Edelburgensis,	Ardagh, Drumcondra.
"	"	Cregg, Nobber.
"	"	Ballykea, Skerries.
"	elegans,	Cornacarrow, Enniskillen.
"	"	Cookstown, Tyrone.
"	"	Killukin, Carrick-on-Shannon.
"	"	Armagh, Armagh.
"	fimbriata,	Ardagh, Drumcondra.
"	"	Cookstown, Tyrone.
"	"	Mullawornia, Ballymahon.
"	"	Little Island, Cork.
"	flexistria,	Millicent, Clane.
"	"	St. Doolough's, Dublin.
"	fragaria,	Little Island, Cork.
"	"	Ardclogh, Rathcoole.
"	"	Howth, Howth.
"	gigantea,	Kiltullagh, Roscommon.
"	granulosa,	Millicent, Clane.
"	"	Killukin, Carrick-on-Shannon.
"	hemispherica,	Dundonagh.
"	"	Kilmore, Armagh.
"	"	Little Island, Cork.
"	"	Ballyhoe Lake, Drumcondra.
"	intermedia,	*See* Inoceramus orbicularis.
"	laciniata,	Millicent, Clane.
"	"	Ballyduff, Dungarvan.
"	latissima,	Tullyoran, Mohill.
"	laxispina,	Ardagh, Drumcondra.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Producta	laxispina, ...	Salmon, Man-of-War, Balbriggan.
"	lirata, ...	Ballyduff, Dungarvan.
"	"	Howth, Howth.
"	margaritacæa, ...	Howth, Howth.
"	"	Millicent, Clane.
"	Martini, ...	Rathgillen, Nobber.
"	"	Lisardrea, Boyle.
"	"	Cookstown, Tyrone.
"	"	Ardagh, Dumcondra.
"	"	Mullaghfin, Duleek.
"	maxima, ...	Cregg, Nobber.
"	mesoloba, ...	Millicent, Clane.
"	"	Ardagh, Drumcondra.
"	"	Laracor, Trim.
"	"	Little Island, Cork.
"	"	Tankardstown, Kildorrery.
"	muricata, ...	Moore, Ballinasloe.
"	ovalis, ...	Carrigaline, Cork.
"	pectinoides, ...	Ballyduff, Dungarvan.
"	"	Ardclogh, Rathcoole.
"	"	Cregg, Nobber.
"	"	Millicent, Clane.
"	"	Salmon, Man-of-War, Balbriggan.
"	"	Rathgillen, Nobber.
"	punctata, ...	Drummanmore, Armagh.
"	pugilis, ...	Rathcline, Longford.
"	"	Boyle, Roscommon.
"	punctata, ...	Little Island, Cork.
"	"	Rathmoyle House, Roscommon.
"	"	Salmon, Man-of-War, Balbriggan.
"	"	Rathgillen, Nobber.
"	pustulosa, ...	Tankardstown, Kildorrery.
"	"	Ardagh, Drumcondra.
"	"	Milverton, Skerries.
"	quincuncialis, ...	Little Island, Cork.
"	"	Rathcline, Longford.
"	"	Cornacarrow, Enniskillen.
"	"	Tullyoran, Mohill.
"	rugata, ...	Howth, Howth.
"	"	Ballyduff, Dungarvan.
"	"	Millicent, Clane.
"	scabricula, ...	Drumdoe, Boyle.
"	"	Kiltullagh, Castlereagh.
"	"	St. Doolough's, Dublin.
"	"	Cornacarrow, Enniskillen.
"	Scotica, ...	Little Island, Cork.
"	"	Cookstown, Tyrone.
"	"	Dundonagh.
"	"	Monaghan, Monaghan.
"	"	Mullaghliss, Monaghan.
"	setosa, ...	Rathcline, Lanesborough.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Producta	setosa, ...	Cookstown, Tyrone.
"	"	Millicent, Clane.
"	"	Little Island, Cork.
"	spinosa, ...	Howth, Howth.
"	"	Boyle, Roscommon.
"	"	Grangemore, Boyle.
"	striata, ...	Ardagh, Drumcondra.
"	sublævis, ...	Ardagh, Drumcondra.
"	sulcata, ...	Cregg, Nobber.
"	"	Ardagh, Drumcondra.
"	"	Ballykea, Skerries.
"	"	Rathgillen, Nobber.
"	"	Armagh, Armagh.
"	"	Tankardstown, Kildorrery.
"	tortilis, ...	Tullanaguiggy, Fermanagh.
Leptagonia	analoga, ...	Cornacarrow, Enniskillen.
		Killukin, Carrick-on-Shannon.
"	"	Middleton, Cork.
"	"	Rathgillen, Nobber.
"	"	Millicent, Clane.
"	multirugata, ...	Millicent, Clane.
"	plicatilis, ...	Salmon, Man-of-War, Balbriggan.
"	plicatilis, ...	Ardagh, Drumcondra.
"	"	Rathcline, Longford.
"	"	Little Island, Cork.
Leptæna,	" ?	Millicent, Clane.
"	Hardrensis, ...	Ballyduff, Dungarvan.
"	"	Lisardrea, Boyle.
"	"	Termon, Boyle.
"	serrata, ...	Millicent, Clane.
"	volva, ...	Millicent, Clane.
	DELTHYRIDÆ.	
Orthis	connivens, ...	Little Island, Cork.
"	crenistria, ...	Ardagh, Drumcondra.
"	"	Longford, Longford.
"	"	Carrigaline, Cork.
"	"	Tankardstown, Kildorrery.
"	"	Millicent, Clane.
"	divaricata, ...	Millicent, Clane.
"	"	Ballyduff, Dungarvan.
"	filiaria, ...	Grangemore, Boyle.
"	"	Lisardrea, Boyle.
"	"	Howth, Howth.
"	gibbera, ...	Cornacarrow, Enniskillen.
"	Kellii, ...	Annaghilla, Ballygawley.
"	"	Monaghan, Monaghan.
"	longisulcata, ...	Ballyduff, Dungarvan.
"	papilionacea, ...	Termon, Boyle.
"	"	Cregg, Nobber.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Orthis	papilionacea, ...	Ardclogh, Rathcoole.
"	"	Millicent, Clane.
"	radialis, ...	Ardagh, Drumcondra.
"	resupinata, ...	Cornacarrow, Enniskillen.
"	"	Little Island, Cork.
"	"	Millicent, Clane.
"	tuberculata, ...	Millicent, Clane.
Spirifera	attenuata, ...	Cornacarrow, Enniskillen.
"	"	Millicent, Clane.
"	"	Moore, Roscommon.
"	"	Cloghran, Maryborough.
"	"	Cregg, Nobber.
"	bisulcata, ...	Millicent, Clane.
"	"	Rathcline, Longford.
"	calcarata, ...	Little Island, Cork.
"	choristites, ...	Little Island, Cork.
"	crispa, ...	Cregg, Nobber.
"	decemcostata, ...	Millicent, Clane.
"	disjuncta, ...	Little Island, Cork.
"	gigantea, ...	Carrigaline, Cork.
"	"	Tullyoran, Mohill.
"	octoplicata, ...	Cregg, Nobber.
"	ornithorhyncha, . . .	Millicent, Clane.
"	ostiolata, ...	Clonturk, Carrickmacross.
"	princeps, ...	Millicent, Clane.
"	quinqueloba, ...	Ardagh, Drumcondra.
"	rhomboidea, ...	Tankardstown, Kildorrery.
"	"	Rathgillen, Nobber.
"	"	Ardclogh, Rathcoole.
"	rotundata, ...	Cornacarrow, Enniskillen.
"	"	Millicent, Clane.
"	"	Boyle, Roscommon.
"	"	Little Island, Cork.
"	"	Ardclogh, Rathcoole.
"	speciosa, ...	Howth, Howth.
"	striata, ...	Tankardstown, Kildorrery.
"	"	Mullaghfin, Duleek.
"	trigonalis, ...	Ardagh, Drumcondra.
"	"	Salmon, Man-of-War, Balbriggan.
"	"	Mullaghfin, Duleek.
"	"	Cregg, Nobber.
"	Urii, ...	Howth, Howth.
Cyrtia	cuspidata, ...	Millicent, Clane.
"	"	Little Island, Cork.
"	"	Ballyduff, Dungarvan.
"	distans, ...	Cookstown, Tyrone.
"	"	Ballinacourty, Dungarvan.
"	"	Howth, Howth.
"	"	Millicent, Clane.
"	dorsata, ...	Cork.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Cyrtia	linguifera, ...	Rathmoyle House, Roscommon.
"	"	Rathcline, Longford.
"	"	Millicent, Clane.
"	senilis, ...	Armagh, Armagh.
"	"	Cookstown, Tyrone.
"	semicircularis, ...	Slane, Co. Meath.
"	simplex, ...	Blackrock, Cork.
Martinia	decora, ...	Mullaghfin, Duleek.
"	elliptica, ...	Carrigaline, Cork.
"	"	Millicent, Clane.
"	"	Ardagh, Drumcondra.
"	glabra, ...	Millicent, Clane.
"	"	Little Island, Cork.
"	"	Cornacarrow, Enniskillen.
"	oblata, ...	Armagh, Armagh.
"	"	Milverton, Skerries.
"	"	Mullaghfin, Duleek.
"	"	Ardagh, Drumcondra.
"	"	Cornacarrow, Enniskillen.
"	"	Cregg, Nobber.
"	"	Rathcline, Longford.
"	obtusa, ...	Tullyoran, Mohill.
"	"	Rathcline, Longford.
"	"	Little Island, Cork.
"	"	Howth, Howth.
"	plebeia, ...	Millicent, Clane.
"	"	Ardagh, Drumcondra.
"	"	Little Island, Cork.
"	"	Mullaghfin, Duleek.
"	"	Cookstown, Tyrone.
"	"	Armagh, Armagh.
"	rhomboidalis, ...	Cork.
"	symmetrica, ...	Mullaghfin, Duleek.
Reticularia	imbricata, ...	Little Island, Cork.
"	"	Ardagh, Drumcondra.
"	"	Rathmoyle House, Roscommon.
"	"	Mullawornia, Ballymahon.
"	lineata, ...	Curkeen, Rush.
"	"	Little Island, Cork.
"	"	Tankardstown, Kildorrery.
"	reticulata, ...	Armagh, Armagh.
Brachythyris	duplicicosta, ...	Armagh, Armagh.
"	"	Mullaghfin, Duleek.
"	exarata, ...	Rathcline, Longford.
"	integricosta, ...	Armagh, Armagh.
"	ovalis, ...	Ballyduff, Dungarvan.
"	pinguis, ...	Rathcline, Longford.
"	"	Rush, Rush.
"	"	Millicent, Clane.
"	"	Tirlecken, Ballymahon.
"	"	St. Doolough's.

Names of Fossils — Genera.	Names of Fossils — Species.	Localities and Post-Towns.
Brachythyris	planicostata, ...	Mullaghfin, Duleek.
”	”	Milverton, Skerries.
Athyris	decussata, ...	Howth, Howth.
”	expansa, ...	Ardagh, Drumcondra.
”	”	Armagh, Armagh.
”	”	Milverton, Skerries.
”	”	Drumdoe, Boyle.
”	fimbriata, ...	Boyle, Roscommon.
”	glabristria, ...	Little Island, Cork.
”	”	Laghy, Donegal.
”	”	Clare, Cookstown.
”	”	Millicent, Clane.
”	”	Rathcline, Longford.
”	globularis, ...	Ardagh, Drumcondra.
”	planosulcata, ...	Rathgillen, Nobber.
”	squamosa, ...	Moore, Roscommon.
”	”	Ardagh, Drumcondra.
”	”	Hook Head, Fethard.
Actinoconchus	paradoxus, ...	Knockagh, Dundalk.
”	”	Little Island, Cork.
”	”	Mullawornia, Ballymahon.
”	”	Millicent, Clane.
	TEREBRATULIDÆ.	
Atrypa	acuminata, ...	Salmon, Man-of-War, Balbriggan.
”	”	Kiltullagh, Roscommon.
”	”	Little Island, Cork.
”	anisodonta, ...	Cork.
”	bifera, ...	Mullaghfin, Duleek.
”	”	Millicent, Clane.
”	cordiformis, ...	Little Island, Cork.
”	”	Millicent, Clane.
”	excavata, ...	Ardagh, Drumcondra.
”	ferita, ...	Millicent, Clane.
”	hastata, ...	Rathmoyle House, Roscommon.
”	”	Millicent, Clane.
”	”	Armagh, Armagh.
”	isorhyncha, ...	Cookstown, Tyrone.
”	”	*Incerti loci.*
”	lachryma, ...	Howth, Dublin.
”	laticliva, ...	Cookstown, Tyrone.
”	obtusa, ?	Milverton, Skerries.
”	platyloba, ...	Little Island, Cork.
”	pleurodon, ...	Cregg, Nobber.
”	pugnus	Ardagh, Drumcondra.
”	”	Mullaghfin, Duleek.
”	”	Millicent, Clane.
”	”	Ardelogh, Rathcoole.
”	”	Rathcline, Longford.
”	radialis, ...	Cookstown, Tyrone.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Atrypa	radialis,	Fymore Todd, Augher.
,,	reniformis, ...	Millicent, Clane.
,,	sacculus, ...	Millicent, Clane.
,,	,,	Ardagh, Drumcondra.
,,	,,	Howth.
,,	,,	Little Island, Cork.
,,	sulcirostris, ...	Howth.
,,	,,	Drumdoe, Boyle.
,,	,,	Cregg, Nobber.
,,	triangularis, ...	Little Island, Cork.
,,	ventilabrum, ...	Howth.
,,	,,	Ardagh, Drumcondra.
,,	virgo, ...	Cookstown, Cookstown.
Seminula	pentahedra, ...	Millicent, Clane.
,,	pisum, ...	Howth, Howth.
,,	,,	Laracor, Trim.
,,	rhomboidea, ...	Howth.
	CRUSTACEA.	
Griffithides	globiceps, ...	Millicent, Clane.
,,	,,	*Incerti loci.*
,,	obsoletus, ...	Rush, Rush.
Phillipsia	cœlata, ...	No loc.
,, ?	discors, ?	Millicent, Clane.
,,	gemmulifera, ...	Millicent, Clane.
,,	,,	Howth.
,,	Jonesii, ...	Ballygasey, Loughgall.
,,	Kellii, ...	Cookstown, Tyrone.
,,	mucronata, ...	Kildress, Cookstown.
,,	quadriserialis, ...	Millicent, Clane.
,,	truncatula, ...	Howth.
Dithyrocaris	tenuistriatus, ...	Little Island, Cork.
Entomoconchus	Scouleri, ...	Little Island, Cork.
,,	,,	Millicent, Clane.
Cythere	inflata, ...	Ballyduff, Dungarvan.
,,	,,	Laracor, Trim.
	ANNELIDA.	
Sabella	antiqua, ...	Kildress, Cookstown.
	ECHINODERMATA.	
Palæchinus	ellipticus, ...	Millicent, Clane.
Echinocrinus	vetustus, ...	Ardagh, Drumcondra.
Platycrinus	rugosus, ...	Ardclogh, Kildare.
,,	,,	Howth, Howth.
,,	,,	Derryvullan, Enniskillen.
Poteriocrinus	impressus, ...	Millicent, Clane.
Cyathocrinus	pinnatus, ...	Rinniskiddy, Cork.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Rhodocrinus	abnormis, ...	Millicent, Clane.
Actinocrinus	amphora, ...	Derryvullan, Enniskillen.
,,	polydactylus, ...	Millicent, Clane.
,,	triacontadactylus, . . .	Ardclogh, Rathcoole.
,,	,,	Cregg, Nobber.
,,	,,	Armagh, Armagh.
,,	,,	Millicent, Clane.
	ZOOPHYTA.	
Amplexus	Sowerbii, ...	Moore, Roscommon.
,,	,,	Millicent, Clane.
,,	,,	Cornacarrow, Enniskillen.
,,	,,	Little Island, Cork.
,,	tortuosus, ...	Ballyduff, Dungarvan.
,,	,,	Mullawornia, Ballymahon.
Turbinolia	expansa, ...	Little Island, Cork.
,,	fungites, ...	Termon, Boyle.
,,	,,	Lough Erne, Fermanagh.
,,	,,	Ardagh, Drumcondra.
,,	,,	Little Island, Cork.
,,	,,	Cleene, Roscommon.
Siphonophyllia	cylindrica, ...	Carlingford, Carlingford.
Astræa	aranea, ...	Magheramore, Tobercurry.
,,	crenularis, ...	Armagh, Armagh.
,,	,,	Tumpher, Stewartstown.
,,	,,	Cookstown, Tyrone.
Lithodendron	affine, ...	*Incerti loci.*
,,	,,	Kiltullagh, Castlereagh.
,,	,,	Cregg Nobber.
,,	cæspitosum, ...	*Incerti loci.*
,,	,,	Cookstown, Tyrone.
,,	irregulare, ...	Rathcline, Lanesborough.
,,	pauciradialis, ...	Magheramore, Tobercurry.
,,	sociale, ...	Roscommon, Roscommon.
,,	,,	Ballygasey, Loughgall.
Lithostrotion	striatum, ...	Rathcline, Lanesborough.
,,	,,	Cookstown, Tyrone.
,,	,,	Tullyard, Armagh.
Syringopora	catenata, ...	*Incerti loci.*
,,	geniculata, ...	Armagh, Armagh.
,,	,,	Malahide, Malahide.
,,	laxa, ...	Kilmore, Armagh.
Aulopora	gigas, ...	Cornacarrow, Enniskillen.
Favosites	capillaris, ...	Armagh, Armagh.
,,	Gothlandica, ...	St. John's Point, Dunkineely.
,, (?)	megastoma ?	Termon, Boyle.
,,	,,	Howth.
,,	,,	Lismore, Aughnacloy.
,, (?)	parasitica ?	Boyle, Roscommon.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Favosites	septosus, ...	New Road, Armagh.
"	spongites, ...	Grangemore, Roscommon.
"	"	Cregg, Nobber.
"	"	Killukin, Carrick-on-Shannon.
"	tenuisepta, ...	Cleene, Roscommon.
Stromatopora	polymorpha, ...	Ballyduff, Dungarvan.
"	subtilis, ...	Curkeen, Rush.
Verticillopora	dubia, ...	Cookstown, Tyrone.
Gorgonia	Lonsdaleiana, ...	Laracor, Trim.
Jania	crassa, ...	St. John's Point, Dunkineely.
Vincularia	dichotoma, ...	Millicent, Clane.
"	"	Howth.
Glauconome	gracilis, ...	Little Island, Cork.
"	grandis, ...	Meelick Chapel, Co. Clare.
"	pluma, ...	Laracor, Trim.
Fenestella	antiqua, ...	Ballinacourty, Dungarvan.
"	crassa, ...	Ballinacourty, Dungarvan.
"	"	Millicent, Clane.
"	flabellata, ...	*See* Ichthyorachis, Newenhami.
"	hemispherica, ...	Little Island, Cork.
"	membranacea, ...	Kilcommock, Longford.
"	"	Millicent, Clane.
"	"	Howth, Howth.
"	Morrisii, ...	Little Island, Cork.
"	plebeia, ...	Little Island, Cork.
"	reticularis, ...	Howth, Howth.
"	tenuifila, ...	Tankardstown, Kildorrery.
"	"	Howth, Howth.
Hemitrypa	Hibernica, ...	Little Island, Cork.
Ichthyorachis	Newenhami, ...	Kilmallock, Co. Limerick.
Retepora	prisca, ...	Ballinacourty, Dungarvan.
"	"	St. Doolough's, Dublin.
"	undata, ...	Ballinacourty, Dungarvan.
"	"	Millicent, Clane.
"	"	Howth, Howth.
Fenestella	undulata, ...	Howth, Howth.

Section II.—Division II.

The Second Division of the Limestone Group consists of the Middle Limestone, or Calp Series.

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.
	MOLLUSCA.	
	Cephalopoda.	
	ORTHOCERATIDÆ.	
Orthoceras	attenuatum, ...	Bundoran, Bundoran.
"	cinctum, ...	Rush, Rush.
"	mucronatum, ...	*Incerti loci.*
Loxoceras	laterale, ...	Bundoran, Bundoran.
Cyrtoceras	tuberculatum, ...	Bundoran.
	Nautilidæ.	
Goniatites	Gibsoni, ...	Paget Priory, Maynooth.
	Gasteropoda.	
	PECTINIBRANCHIA.	
Loxonema	sulculosa, ...	Bundoran, Bundoran.
Lacuna	antiqua, ...	Kilcummin, Killala.
Euomphalus	calyx, ...	Finner, Bundoran.
"	crotalostomus, ...	Finner, Bundoran.
"	pentangulatus, ...	Bundoran, Bundoran.
SCUTIBRANCHIA AND CYCLOBRANCHIA.		
Dirinus	Bucklandi, ...	Manorhamilton, Manorhamilton.
Patella	sinuosa, ...	Bundoran, Bundoran.
	Dithyra.	
	MACROTRACHIA.	
Sanguinolites	angustatus, ...	Ballintrillick, Bundoran.
"	curtus, ...	Manorhamilton, Manorhamilton.
"	Iridinoides, ...	Manorhamilton, Manorhamilton.
"	"	Ballintrillick, Bundoran.
"	plicatus, ...	Ballintrillick, Bundoran.
Lucina	antiqua, ...	Ballintrillick, Bundoran.
Ungulina	antiqua, ...	Bundoran, Bundoran.
Amphidesma	subtruncatum, ...	Bundoran, Bundoran.
Pleurorhynchus	giganteus, ...	Finner, Bundoran.
"	"	Abbeybay, Ballyshannon.
"	minax, ...	Bundoran, Bundoran.
"	"	Finner, Bundoran.
"	nodulosus, ...	Drumod, Mohill.
Cypricardia	subtruncata, ...	Ballintrillick, Bundoran.
Dolabra	rectangularis, ...	Bundoran, Bundoran.

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.
	ATRACHIA.	
Nucula	attenuata, ...	Ballintrillick, Bundoran.
,,	cylindrica, ...	Bundoran, Bundoran.
,,	Phillipsii, ...	Ballintrillick, Bundoran.
Byssoarca	clathrata, ...	Finner, Bundoran.
,,	reticulata, ...	Bundoran, Bundoran.
,,	semicostata, ...	Manorhamilton, Manorhamilton.
Posidonia	Becheri, ...	Cruisetown, Nobber.
,,	,,	Courtlough, Balbriggan.
,,	,,	Rush, Rush.
,,	costata, ...	Rush, Rush.
,,	lateralis, ...	Rush, Rush.
,,	,,	Rush, Rush.
,,	membranacea, ...	Baldongan, Skerries.
,,	,,	Rush, Rush.
,,	,,	Walterstown, Navan.
,,	similis, ...	Courtlough, Balbriggan.
,,	tuberculata, ...	Rush, Rush.
Pteronites	sulcatus, ...	Manorhamilton, Manorhamilton.
Avicula	flabellulum, ...	Bundoran, Bundoran.
,,	laminosa, ...	Bundoran, Bundoran.
,,	squamosa, ...	Ballintrillick, Bundoran.
Pinna	inæquicostata, ...	*Incerti loci.*
Lima	obliqua, ...	Ballintrillick, Bundoran.
,,	semisulcata, ...	Manorhamilton, Manorhamilton.
Pecten	cingendus, ...	Abbeybay, Ballyshannon.
,,	depilis, ...	Ballintrillick, Bundoran.
,,	ellipticus, ...	Ballintrillick, Bundoran.
,,	granulosus, ...	Ballintrillick, Bundoran.
,,	interstitialis, ...	Ballintrillick, Bundoran.
,,	megalotis, ...	Bundoran, Bundoran.
,,	,,	Manorhamilton, Manorhamilton.
,,	plano-clathratus, . . .	Bundoran, Bundoran.
,,	plicatus, ...	Rush, Rush.
,,	,,	Ballintrillick, Bundoran.
,,	polytrichus, ...	Ballintrillick, Bundoran.
,,	sclerotis, ...	Bundoran, Bundoran.
,,	segregatus, ...	Manorhamilton, Manorhamilton.
,,	Sowerbii, ...	Ballintrillick, Bundoran.
,,	,,	Bundoran, Bundoran.
,,	tabulatus, ...	Ballintrillick, Bundoran.
,,	variabilis, ...	Bundoran, Bundoran.
	BRACHIOPODA.	
	ORBICULIDÆ.	
Orbicula	nitida, ...	Bundoran, Bundoran.
Producta	aculeata, ...	Rush, Rush.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Producta	antiquata, ...	Manorhamilton, Manorhamilton.
,,	concinna, ...	Rush, Rush.
,,	,,	Abbeybay, Ballyshannon.
,,	,,	Finner, Bundoran.
,,	corrugata, ...	Ballintrillick, Bundoran.
,,	elegans, ...	Ballintrillick, Bundoran.
,,	fimbriata, ...	Bundoran, Bundoran.
,,	,,	Ballintrillick, Bundoran.
,,	granulosa, ...	Manorhamilton, Manorhamilton.
,,	,,	Rush, Rush.
,,	hemispherica, ...	Ballintrillick, Bundoran.
,,	,,	Rush, Rush.
,,	latissima, ...	Kesh, Fermanagh
,,	lobata, ...	Ballintrillick, Bundoran.
,,	longispina, ...	Finner, Bundoran.
,,	,,	Abbeybay, Ballyshannon.
,,	,,	Bundoran, Bundoran.
,,	margaritacea, ...	Bundoran, Bundoran.
,,	,,	Ballintrillick, Bundoran.
,,	,,	Finner, Bundoran.
,,	Martini, ...	Finner, Bundoran.
,,	membranacea, ...	Rush, Rush.
,,	ovalis, ...	Bundoran, Bundoran.
,,	pectinoides, ...	Abbeybay, Ballyshannon.
,,	,,	Ballintrillick, Bundoran.
,,	pugilis, ...	Manorhamilton, Manorhamilton.
,,	,,	Ballintrillick, Bundoran.
,,	punctata, ...	Bundoran, Bundoran.
,,	quincuncialis, ...	Bundoran, Bundoran.
,,	rugata, ...	Rush, Rush.
,,	scabricula, ...	Bundoran, Bundoran.
,,	Scotica, ...	Ballintrillick, Bundoran.
,,	setosa, ...	Bundoran, Bundoran.
,,	,,	Ballintrillick, Bundoran.
,,	,,	Finner, Bundoran.
,,	spinosa, ...	Ballintrillick, Bundoran.
,,	sulcata, ...	Ballintrillick, Bundoran.
,,	,,	Bundoran, Bundoran.
Leptagonia	analoga, ...	Ballintrillick, Bundoran.
,,	,,	Abbeybay, Ballyshannon.
,,	plicatilis, ...	Rush, Rush.
Leptæna	convoluta, ...	Ballintrillick, Bundoran.
,,	,,	Rush, Rush.
,,	crassistria, ...	Finner, Bundoran.
,,	,,	Bundoran, Bundoran.
,,	Hardrensis, ...	Ballintrillick, Bundoran.
,,	,,	Finner, Bundoran.
,,	,,	Bundoran, Bundoran.
,,	papyracea, ...	Courtlough, Man of War, Balbriggan.
,,	sordida, ...	Bundoran, Bundoran.
,,	volva, ...	Bundoran, Bundoran.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Orthis	arcuata, ...	Manorhamilton, Manorhamilton.
,,	crenistria, ...	Bundoran, Bundoran.
,,	,,	Ballintrillick, Bundoran.
,,	filiaria, ...	Finner, Bundoran.
,,	,,	Abbeybay, Ballyshannon.
,,	papilionacea, ...	Bundoran, Bundoran.
,,	parallela, ...	Bundoran, Bundoran.
,,	quadrata ?	Ballintrillick, Bundoran.
,,	radialis, ...	Ballintrillick, Bundoran.
,,	resupinata, ...	Ballintrillick, Bundoran.
,,	,,	Bundoran, Bundoran.
,,	semicircularis, ...	Abbeybay, Ballyshannon.
,,	tenuistriata ?	Ballintrillick, Bundoran.
Spirifera	attenuata, ...	Bundoran, Bundoran.
,,	,,	Finner, Bundoran.
,,	bisulcata, ...	Ballintrillick, Bundoran.
,,	calcarata, ...	Bundoran, Bundoran.
,,	crispa, ...	Ballintrillick, Bundoran.
,,	gigantea, ...	Finner, Bundoran.
,,	,,	Abbeybay, Ballyshannon.
,,	,,	Bundoran, Bundoran.
,,	octoplicata, ...	Bundoran, Bundoran.
,,	ostiolata, ...	Ballintrillick, Bundoran.
,,	,,	Bundoran, Bundoran.
,,	speciosa, ...	Bundoran, Bundoran.
,,	,,	Ballintrillick, Bundoran.
,,	,,	Abbeybay, Ballyshannon.
,,	Urii, ...	Ballintrillick, Bundoran.
,,	,,	Manorhamilton, Manorhamilton.
Cyrtia	distans, ...	Bundoran, Bundoran.
,,	laminosa, ...	Ballintrillick, Bundoran.
,,	,,	Abbeybay, Ballyshannon.
,,	,,	Finner, Bundoran.
,,	subconica, ...	Bundoran, Bundoran.
Martinia	glabra, ...	Ballintrillick, Bundoran.
,,	plebeia, ...	Ballintrillick, Bundoran.
,,	,,	Finner, Bundoran.
Reticularia	imbricata, ...	Ballintrillick, Bundoran.
,,	lineata, ...	Rush, Rush.
,,	microgemma, ...	Bundoran, Bundoran.
Brachythyris	duplicicosta, ...	Ballintrillick, Bundoran.
,,	exarata, ...	Ballintrillick, Bundoran.
,,	integricosta, ...	Bundoran, Bundoran.
,,	,,	Ballintrillick, Bundoran.
,,	pinguis, ...	Ballintrillick, Bundoran.
,,	planata, ...	Bundoran, Bundoran.
,,	,,	Ballintrillick, Bundoran.
Athyris	concentrica, ...	Finner, Bundoran.
,,	decussata, ...	Manorhamilton, Manorhamilton.
,,	,,	Abbeybay, Ballyshannon.
,,	expansa, ...	Finner, Bundoran.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Athyris	fimbriata, ...	Bundoran, Bundoran.
"	glabristria, ...	Bundoran, Bundoran.
Atrypa	fallax, ...	Ballintrillick, Bundoran.
"	hastata, ...	Ballintrillick, Bundoran.
"	juvenis, ...	Rush, Rush.
"	pleurodon, ...	Abbeybay, Ballyshannon.
"	semisulcata, ...	Rush, Rush.
"	"	Walterstown, Skreen.
"	sulcirostris, ...	Ballintrillick, Bundoran.
"	ventilabrum, ...	Manor Hamilton, Manorhamilton.
Seminula	pentahedra, ...	Ballintrillick, Bundoran.
	CRUSTACEA.	
Griffithides	obsoletus, ...	Ballintrillick, Bundoran.
Phillipsia	gemmulifera, ...	Ballintrillick, Bundoran.
Cythere	gibberula, ...	Ballintrillick, Bundoran.
"	scutulum, ...	Ballintrillick, Bundoran.
	ANNELIDA.	
Serpula ?	compressa, ...	Bundoran, Bundoran.
"	hexicarinata, ...	Bundoran, Bundoran.
"	parallela, ...	Ballintrillick, Bundoran.
"	"	Finner, Bundoran.
"	"	Abbeybay, Ballyshannon.
Spirorbis	globosus, ...	Ballymacan, Clogher.
Serpulites	carbonarius, ...	Manorhamilton, Manorhamilton.
	ECHINODERMATA.	
Palæchinus	Kœnigii, ?	Finner, Bundoran.
Echinocrinus	glabrispina, ...	Bundoran, Bundoran.
"	Urii, ...	Ballintrillick, Bundoran.
"	"	Bundoran, Bundoran.
Platycrinus	expansus, ...	Finner, Bundoran.
"	laciniatus, ...	Finner, Bundoran.
Taxocrinus	polydactylus, ...	Ballintrillick, Bundoran.
"	"	Carrowmably, Easky.
Cyathocrinus	ellipticus, ...	Finner, Bundoran.
"	pinnatus ?	Bundoran, Bundoran.
"	planus, ...	Belmore Mountain, Enniskillen.
"	variabilis, ...	Ballintrillick, Bundoran.
Actinocrinus	tenuistriatus, ...	Bundoran, Bundoran.
	ACRITA.	
	ZOOPHYTA.	
Turbinolia	fungites, ...	Swanlinbar, Ballyconnell.
Siphonophyllia	cylindrica, ...	Manorhamilton, Manorhamilton.

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.
Lithodendron	affine, ...	Manorhamilton, Manorhamilton.
"	sociale, ...	Ballintrillick, Bundoran.
Favosites ?	megastoma ?	Bundoran, Bundoran.
"	spongites, ...	Ballintrillick, Bundoran.
"	tenuisepta, ...	Finner, Bundoran.
Verticillopora	abnormis ?	Ballintrillick, Bundoran.
Flustra	palmata, ...	Manorhamilton, Manorhamilton.
Millepora	gracilis, ...	Ballintrillick, Bundoran.
"	oculata, ...	Ballintrillick, Bundoran.
"	"	Rush, Rush.
Jania	crassa, ...	Abbeybay, Ballyshannon.
Glauconome	bipinnata, ...	Bundoran, Bundoran.
"	pluma, ...	Bundoran, Bundoran.
"	"	Finner, Bundoran.
Fenestella	antiqua, ...	Ballintrillick, Bundoran.
"	polyporata, ...	Ballintrillick, Bundoran.
"	nodulosa, ...	Ballintrillick, Bundoran.
"	reticularis, ...	Bundoran, Bundoran.
"	tenuifila, ...	Ballintrillick, Bundoran.
"	undulata, ...	Ballintrillick, Bundoran.
Hemitrypa	Hibernica, ...	Ballintrillick, Bundoran.

Section II.—Division III.

The Third Division of the Limestone Group, or Upper Limestone.

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.
MOLLUSCA.		
Cephalopoda.		
SIPHONIFERA OR TETRABRANCHIATA.		
Family.—Orthoceratidæ.		
Orthoceras	attenuatum, ...	Castlecreagh, Doneraile.
"	"	Black Lion, Enniskillen.
"	cylindraceum, ...	Ballycastle, Antrim.
"	"	Black Lion, Enniskillen.
"	pyramidale, ...	Doneraile, Cork.
Loxoceras	Breynii, ...	Streamhill, Doneraile.
"	laterale, ...	Doneraile, Cork.
Campyloceras	arcuatum, ...	Black Lion, Enniskillen.
Cycloceras	annulare, ...	Ballycastle, Antrim.
"	lineolatum, ...	Doneraile, Cork.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Family.—NAUTILIDÆ.		
Goniatites	excavatus, ...	Black Lion, Enniskillen.
"	obtusus, ...	Doneraile, Cork.
"	striolatus, ...	Black Lion, Enniskillen.
Discites	mutabilis, ...	Annagh, Charleville.
"	sulcatus, ...	Black Lion, Enniskillen.
Temnocheilus	globatus, ...	Fortwilliam, Doneraile.
Nautilus	cyclostomus, ...	Black Lion, Enniskillen.
Bellerophon	reticulatus, ...	Ballycastle, Antrim.
Euphemus	Urii, ...	Ballycastle, Antrim.
GASTEROPODA.		
PECTINIBRANCHIATA.		
Turritella	suturalis, ...	Black Lion, Enniskillen.
Naticopsis	Phillipsii, ...	Streamhill, Doneraile.
"	spirata, ...	Black Lion, Enniskillen.
Murchisonia	quadricarinata, ...	Black Lion, Enniskillen.
SCUTIBRANCHIA AND CYCLOBRANCHIA.		
Açroculia	vetusta, ...	Manorhamilton, Manorhamilton.
DITHYRA.		
MACROTRACHIA.		
Solenopsis	minor, ...	Drumreagh, Dungannon.
Sanguinolites	Iridinoides, ...	Roughan, Dungannon.
"	radiatus, ...	Killymeal, Dungannon.
Lutraria	prisca, ...	Black Lion, Enniskillen.
Cypricardia	cuneata, ...	Black Lion, Black Lion.
ATRACHIA.		
Nucula	attenuata, ...	Ballycastle, Antrim.
Arca	cancellata, ...	Black Lion, Black Lion.
Cucullæa	arguta, ...	Black Lion, Enniskillen.
Byssoarca	costellata, ...	Black Lion, Enniskillen.
"	reticulata, ...	Black Lion, Enniskillen.
Lanistes	obtusus, ...	Killymeal, Dungannon.
Inoceramus	vetustus, ...	Black Lion, Enniskillen.
Meleagrina	quadrata, ...	Black Lion, Enniskillen.
"	radiata, ...	Black Lion, Enniskillen.
"	"	Carrowtremal, Enniskillen.
"	tessellata, ...	Knockninny, Enniskillen.
Pteronites	semisulcatus, ...	Black Lion, Black Lion.
"	"	Killymeal, Dungannon.
Avicula	gibbosa, ...	Manorhamilton, Manorhamilton.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Lima	alternata,	Killymeal, Dungannon.
"	decussata,	Killymeal, Dungannon.
"	lævigata,	Black Lion, Enniskillen.
Pecten	æqualis,	Killymeal, Dungannon.
"	arenosus,	Knockninny, Enniskillen.
"	asperulus,	Black Lion, Black Lion.
"	cancellatulus,	Killymeal, Dungannon.
"	concentrico-striatus,	Killymeal, Dungannon.
"	ellipticus,	Killymeal, Dungannon.
"	flabellulum,	Ballycastle, Antrim.
"	gibbosus,	Black Lion, Enniskillen.
"	granosus,	Killymeal, Dungannon.
"	granulosus,	Ballyconnell, Ballyconnell.
"	intercostatus,	Killymeal, Dungannon.
"	interstitialis,	Knockninny, Enniskillen.
"	"	Black Lion, Enniskillen.
"	"	Carrowtremal, Enniskillen.
"	Jonesii,	Black Lion, Black Lion.
"	megalotis,	Black Lion, Enniskillen.
"	"	Ballintrillick, Bundoran.
"	tripartitus,	Killymeal, Dungannon.
	BRACHIOPODA.	
Producta	aculeata,	Old Leighlin, Leighlin Bridge.
"	"	Manorhamilton, Manorhamilton.
"	concinna,	Black Lion, Enniskillen.
"	"	Killymeal, Dungannon.
"	"	Belmore Mountain, Enniskillen.
"	corrugata,	Black Lion, Enniskillen.
"	costellata,	Old Leighlin, Leighlin Bridge.
"	Edelburgensis,	Ballycastle, Antrim.
"	elegans,	Manorhamilton, Manorhamilton.
"	gigantea,	Killymeal, Dungannon.
"	granulosa,	Black Lion, Enniskillen.
"	latissima,	Bannaghagole, Leighlin Bridge.
"	"	Killymeal, Dungannon.
"	"	Cartronaglogh, Keadue.
"	laxispina,	Black Lion, Enniskillen.
"	"	Manorhamilton, Manorhamilton.
"	Martini,	Ballycastle, Antrim.
"	"	Killymeal, Dungannon.
"	mesoloba,	Black Lion, Enniskillen.
"	pectinoides,	Black Lion, Enniskillen.
"	pugilis,	Ballintrillick, Bundoran.
"	punctata,	Knockninny, Enniskillen.
"	"	Old Leighlin, Leighlin Bridge.
"	pustulosa,	Black Lion, Enniskillen.
"	quincuncialis,	Old Leighlin, Leighlin Bridge.
"	rugata,	Black Lion, Black Lion.
"	scabricula,	Ballycastle, Antrim.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Producta	Scotica, ...	Ballycastle, Antrim.
"	setosa, ...	Black Lion, Enniskillen.
"	"	Ballintrillick, Bundoran.
"	spinosa, ...	Black Lion, Enniskillen.
"	sulcata, ...	Knockninny, Enniskillen.
"	"	Black Lion, Enniskillen.
"	"	Cartronaglogh, Keadue.
Leptagonia	analoga, ...	Black Lion, Enniskillen.
"	plicatilis, ...	Manorhamilton, Manorhamilton.
Leptæna	Hardrensis, ...	Old Leighlin, Leighlin Bridge.
"	"	Ballycastle, Antrim.
Orthis	crenistria, ...	Black Lion, Enniskillen.
"	filiaria, ...	Old Leighlin, Leighlin Bridge.
"	"	Bannaghagole, Leighlin Bridge.
"	resupinata, ...	Carrowtremal, Enniskillen.
Spirifera	attenuata, ...	Black Lion, Enniskillen.
"	bisulcata, ...	Black Lion, Enniskillen.
"	gigantea, ...	Manorhamilton, Manorhamilton.
"	minima, ...	Churchill, Fermanagh.
"	"	Black Lion, Enniskillen.
"	"	Old Leighlin, Leighlin Bridge.
"	rhomboidea, ...	Knockninny, Enniskillen.
"	"	Black Lion, Enniskillen.
"	speciosa, ...	Manorhamilton, Manorhamilton.
Cyrtia	linguifera, ...	Black Lion, Enniskillen.
"	semicircularis, ...	Ballycastle, Antrim.
Martinia	plebeia, ...	Black Lion, Enniskillen.
Reticularia	imbricata, ...	Black Lion, Enniskillen.
"	reticulata, ...	Ballycastle, Antrim.
"	"	Bannaghagole, Leighlin Bridge.
Brachythyris	exarata, ...	Old Leighlin, Leighlin Bridge.
"	pinguis, ...	Cartronaglogh, Keadue.
"	planicostata, ...	Old Leighlin, Leighlin Bridge.
"	"	Bannaghagole, Leighlin Bridge.
"	"	Killymeal, Dungannon.
Athyris	fimbriata, ...	Black Lion, Enniskillen.
"	globularis, ...	Churchill, Fermanagh.
Actinoconchus	paradoxus, ...	Black Lion, Enniskillen.
TEREBRATULIDÆ.		
Atrypa	flexistria, ...	Knockninny, Enniskillen.
"	hastata, ...	Black Lion, Enniskillen.
"	pleurodon, ...	Black Lion, Enniskillen.
"	pugnus, ...	Black Lion, Enniskillen.
"	sacculus, ...	Black Lion, Enniskillen.
"	sulcirostris, ...	Knockninny, Enniskillen.
"	ventilabrum, ...	Black Lion, Enniskillen.
Seminula	rhomboidea, ...	Black Lion, Enniskillen.
Griffithides	calcaratus, ...	Roughan, Dungannon.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Griffithides	obsoletus, ...	Cartronaglogh, Keadue.
Phillipsia	cælata, ...	Killymeal, Dungannon.
Entomoconchus	Scouleri, ...	Black Lion, Enniskillen.
ECHINODERMATA.		
Echinocrinus	Urii, ...	Manorhamilton, Manorhamilton.
Pentremites	Derbiensis, . . .	Knockninny, Enniskillen.
"	"	Manorhamilton, Manorhamilton.
"	ellipticus, ...	Manorhamilton, Manorhamilton.
"	florealis, ...	Black Lion, Enniskillen.
Cyathocrinus	variabilis, ...	Ballintrillick, Bundoran.
Actinocrinus	constrictus, ...	Manorhamilton, Manorhamilton.
"	costus, ...	Manorhamilton, Manorhamilton.
"	triacontadactylus, . . .	Manorhamilton, Manorhamilton.
ACRITA.		
ZOOPHYTA.		
Amplexus	tortuosus, ...	Black Lion, Enniskillen.
Turbinolia	fungites, ...	Belmore Mountain, Enniskillen.
Lithostrotion	striatum, ...	Bannaghagole, Leighlin Bridge.
"	"	Raheendoran, Carlow.
Lithodendron	affine, ...	Pulgulin, Swanlinbar.
"	"	Ballyconnell, Ballyconnell.
"	cœspitosum, ...	Raheendoran, Carlow.
Syringopora	laxa, ...	Killymeal, Dungannon.
Favosites	septosus, ...	Raheendoran, Carlow.
"	spongites, ...	Black Lion, Enniskillen.
"	tumida, ...	Ballycastle, Antrim.
"	"	Belmore Mountain, Enniskillen.
"	"	Killymeal, Dungannon.
Tragos	semicirculare, ...	Manorhamilton, Manorhamilton.
Vincularia	dichotoma, ...	Black Lion, Enniskillen.
"	"	*Incerti loci.*
"	megastoma, ...	Killymeal, Dungannon.
"	parallela, ...	Killymeal, Dungannon.
"	raricosta, ...	Killymeal, Dungannon.
Glauconome	bipinnata, ...	Black Lion, Enniskillen.
"	gracilis, ...	Killymeal, Dungannon.
"	pluma, ...	Black Lion, Enniskillen.
"	"	Belmore Mountain, Enniskillen.
"	"	Killymeal, Dungannon.
"	pulcherrima, ...	Black Lion, Black Lion.
Fenestella	crassa, ...	Black Lion, Black Lion.
"	ejuncida, ...	Black Lion, Enniskillen.
"	formosa, ...	Killymeal, Dungannon.
"	frutex, ...	Killymeal, Dungannon.
"	laxa, ...	Belmore Mountain, Enniskillen.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
Fenestella	laxa,	Black Lion, Enniskillen.
"	multiporata,	Ballintrillick, Bundoran.
"	"	Killymeal, Dungannon.
"	nodulosa,	Black Lion, Enniskillen.
"	"	Ballintrillick, Bundoran.
"	polyporata,	Black Lion, Enniskillen.
"	quadradecimalis,	Black Lion, Enniskillen.
"	tenuifila,	Black Lion, Enniskillen.
"	"	Ballintrillick, Bundoran.
"	undulata,	Black Lion, Enniskillen.
"	varicosa,	Black Lion, Black Lion.
Hemitrypa	Hibernica,	Ballintrillick, Bundoran.
"	"	Black Lion, Enniskillen.
"	"	Knockninny, Enniskillen.
Polypora	marginata,	Killymeal, Dungannon.
"	"	Black Lion, Enniskillen.
"	papillata,	Killymeal, Dungannon.
"	"	Black Lion, Enniskillen.
"	verrucosa,	Black Lion, Enniskillen.
Lower Carboniferous Fishes.		
Palæoniscus	sp.	Moyheeland, Draperstown.
"	"	Mormeal.
"	"	Cultra, Hollywood.
Amblypterus	sp.	Ballynure, Maghera.
"	"	Moyheeland, Draperstown.
Psammodus	porosus,	Hook Head, Fethard.
"	"	Malahide, Dublin.
"	"	Finner, Bundoran.
"	"	Red Barn, Armagh.
Helodus	sp.	Red Barn, Armagh.
"	"	Ballygasey, Loughgall.
"	mammillaris,	Ballinglen, Ballycastle.
"	"	Loughgall, Armagh.
"	planus,	Kilcummin, Lackan Bay.
"	turgidus,	Red Barn, Armagh.
Chomatodus	sp.	Red Barn, Armagh.
Cochliodus	sp.	Poulscadden, Howth.
"	"	Cookstown, Tyrone.
"	contortus,	Ballygasey, Loughgall.
"	gracilis,	Millicent, Clane.
"	magnus,	Finner, Bundoran.
"	"	Red Barn, Armagh.
"	"	Ballygasey, Loughgall.
Cladodus	sp.	College Hall, Tynan.
"	"	Red Barn, Armagh.
"	mirabilis,	Drummanbeg, Armagh.
Petalodus	Hastingsiæ,	Enagh, Tynan.
"	"	Ballygasey, Loughgall.
"	lævissimus,	Red Barn, Armagh.
"	radicans (palatal tritor),	Red Barn, Armagh.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Petalodus	sp.	Ballygasey, Loughgall.
,,	sagittatus, ...	Red Barn, Armagh.
Ctenacanthus	sp.	Monaduff, Drumlish.
,,	,,	Ballygasey, Loughgall.
Asteroptychius	ornatus, ...	Ballygasey, Loughgall.
Oracanthus	Milleri, ...	Monaduff, Drumlish.
Onchus?	sp.	Ballygasey, Loughgall.
Pæcilodus	,,	River Banagh, Kesh.
,,	Jonesi, ...	Red Barn, Armagh.
,,	sublævis, ...	Red Barn, Armagh.
,,	transversus, ...	Red Barn, Armagh.
,,	,,	Ballygasey, Loughgall.
Gyracanthus	obliquus, ...	Moyheeland, Draperstown.
,,	new?	Moyheeland, Draperstown.
,,	tuberculatus, ...	Moyheeland, Draperstown.
,,	spines, ...	Cultra, Hollywood.
Holoptychius	sp.	Moyheeland, Draperstown.
,,	,,	Fallagloon, Maghera.
,,	Portlocki, ...	Ballynure, Maghera.
,,	,,	Fallagloon, Maghera.
,,	,,	Moyheeland, Draperstown.
,,	,,	Cultra, Hollywood.
,,	,,	Monaduff, Drumlish.
Phyllolepis	sp.	Moyheeland, Draperstown.
Chelyophorus	Griffithii, ...	Cultra, Hollywood.
Isodus	leptognathus,.	Moyheeland, Draperstown.
Psammosteus	vermicularis, ...	Fallagloon, Maghera.
,,	granulatus, ...	River Banagh, Kesh.

Section III.

The Coal Group, or Third Section of the Series, consists of the Millstone Grit, and the overlying Coal proper, or uppermost member of the Carboniferous System.

Section III.—Division I.

The Millstone Grit.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
	Cephalopoda.	
	ORTHOCERATIDÆ.	
Orthoceras	cinctum,	Cahernanalt, Keadue.
"	filiferum,	Cahernanalt, Keadue.
"	inæquiseptum,	Cahernanalt, Keadue.
"	laterale,	Derreens, Drumkeeran.
"	"	Skehana, Castlecomer.
"	serratum,	Corry, Drumkeeran.
"	Steinhaueri,	Caher Rush, Milltown Malbay.
"	sulcatulum,	Cahernanalt, Keadue.
"	"	Cuilcagh, Swanlinbar.
Actinoceras	giganteum,	Foynes, Askeaton.
"	"	Cahernanalt, Keadue.
Cyrtoceras	alternatum,	Corry, Drumkeeran.
	Nautilidæ.	
Goniatites	Gilbertsoni,	Cahernanalt, Keadue.
"	Listeri,	Cahernanalt, Keadue.
"	"	Ballybunnion, Co. Kerry.
"	Looneyi,	Cahernanalt, Keadue.
"	micronotus,	Braulieve Mountains, Black Lion.
"	ovatus,	Derreens, Drumkeeran.
"	reticulatus,	Doon, Mount Phelim, Ennistymon.
"	serpentinus,	Cahernanalt, Keadue.
"	striolatus,	Cahernanalt, Keadue.
"	"	Skehana, Castlecomer.
"	vittiger,	Cahernanalt, Keadue.
Nautilus	discors,	Corry, Drumkeeran.
"	Luidii,	Cahernanalt, Keadue.
"	"	Cuilcagh, Swanlinbar.
"	"	Derreens, Drumkeeran.
"	sigmilineus,	Corry, Drumkeeran.
"	spiralis,	Kingwilliamstown, Co. Cork.
	Gasteropoda.	
Euomphalus	parvus,	Skehana, Castlecomer.
Macrocheilus	scaraboides,	Corry, Drumkeeran.

Names of Fossils.		Localities and Post-Towns.
Genera.	Species.	
Littorina	nuciformis,	Cuileagh, Swanlinbar.
,,	carinata,	Rock of Foyle Waterfall, Castlecomer.
Pleurotomaria	ornata,	Corry, Drumkeeran.
Turbo	sp.	Cahernanalt, Keadue.
Patella	mucronata,	Cahernanalt, Keadue.
	DITHYRA.	
Pullastra	elegans,	Cahernanalt, Keadue.
,,	,,	Rock of Foyle Waterfall, Castlecomer.
Lunulacardium	new sp., two of,	Cahernanalt, Keadue.
Cypricardia	alata,	Firoda, Castlecomer.
,,	socialis,	Cahernanalt, Keadue.
Posidonia	Becheri,	Alteen Stream, Swanlinbar.
,,	,,	Cuilcagh, Swanlinbar.
,,	,,	Ennistymon.
,,	lateralis,	Cahernanalt, Keadue.
,,	membranacea,	Cahernanalt, Keadue.
,,	,,	Firoda, Castlecomer.
,,	pusilla,	Braulieve Mountains, Black Lion.
Modiola	sp.	Bilboa Colliery, Carlow.
Pecten	concentricus,	Cahernanalt, Keadue.
,,	ellipticus,	Cahernanalt, Keadue.
,,	granulosus,	Cahernanalt, Keadue.
,,	variabilis,	Cahernanalt, Keadue.
,,	papyraceus,	Corry, Drumkeeran.
,,	,,	Skehana, Castlecomer.
,,	,,	Cahernanalt, Keadue.
Unio	sp.	Coal Island, Dungannon.
Lingula	parallela,	Coal Island, Dungannon.
,,	,,	Ennistymon.
	BRACHIOPODA.	
Orbicula	sp.	Mullaun, Keadue.
Producta	concinna,	Cuilcagh, Swanlinbar.
,,	,,	Rock of Foyle Waterfall, Castlecomer.
,,	setosa,	Cahernanalt, Keadue.
,,	mesoloba,	Rock of Foyle Waterfall, Castlecomer.
Leptæna	Hardrensis,	Cahernanalt, Keadue.
Orthis	parallela,	Rock of Foyle Waterfall, Castlecomer.
Spirifera	crispa,	Cahernanalt, Keadue.
,,	glabra,	Cahernanalt, Keadue.
,,	,,	Rock of Foyle Waterfall, Castlecomer.
,,	rotundata,	Corry, Drumkeeran.
,,	Urii,	Lough Allen, Carrick-on-Shannon.
Atrypa	semisulcata,	Cahernanalt, Keadue.
	CRUSTACEA.	
Griffithides	globiceps,	Cahernanalt, Keadue.
,,	,,	Firoda, Castlecomer.
Phillipsia	gemmulifera,	Cahernanalt, Keadue.
,,	,,	Rock of Foyle Waterfall, Castlecomer.

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.
ECHINODERMATA.		
Cyathocrinus	ellipticus, ...	Cahernanalt, Keadue.
Actinocrinus	tenuistriatus, . . .	Cahernanalt, Keadue.
ZOOPHYTA.		
Fenestella	antiqua, ...	Cahernanalt, Keadue.
PLANTS.		
Plants, Lepidodendron, &c., as in Coal, .		Ballycastle Colliery, Antrim, &c.
,,		Raheen, Leighlin Bridge.
,,		Cahir Rush, Milltown Malbay.
Fern stem, ...		Cahernanalt, Keadue.

SECTION III.—DIVISION II.

The uppermost member of the Carboniferous Series, or Coal Proper.

Names of Fossils. Genera.	Names of Fossils. Species.	Localities and Post-Towns.
Bivalve shells and Trilobites, ...		Bilboa Colliery, Carlow.
PLANTS.		
DICOTYLEDONS.		
Stigmaria	ficoides, ...	Dromagh Colliery, Kanturk.
,,	,,	Aghabehy, Keadue.
Sigillaria	organum, ...	Dromagh Colliery, Kanturk.
,,	,,	Crosshill, Keadue.
Favularia	elegans, ...	Annagher Colliery, Coal Island.
Sphenophyllum	erosum, ...	Annagher Colliery, Coal Island.
Asterophyllites	longifolia, ...	Dromagh Colliery, Kanturk.
,,	tuberculata, . . .	New Birmingham, Co. Tipperary.
Pinnularia	capillacea, ...	Dromagh Colliery, Kanturk.
,,	,,	Annagher Colliery, Coal Island.
Bechera	grandis, ...	Annagher Colliery, Coal Island
CELLULARES.		
EQUICETACEÆ.		
Calamites	approximatus, . .	New Birmingham, Co. Tipperary.
,,	cannæformis, . .	Annagher Colliery, Coal Island.
,,	Mougeotii, . . .	New Birmingham, Co. Tipperary.
,,	Suckowii, ...	Annagher Colliery, Coal Island.

Names of Fossils. Genera.	Species.	Localities and Post-Towns.
FILICES.		
Sphenopteris	dilatata, ...	Annagher Colliery, Coal Island.
"	"	Dromagh Colliery, Kanturk.
"	Hibbertii, ...	Annagher Colliery, Coal Island.
"	latifolia, ...	Annagher Colliery, Coal Island.
" (new)	allied to Höningausi,	Aghabehy, Keadue.
"	"	New Birmingham, Co. Tipperary.
"	obtusiloba, ...	Queen's County, Leinster Coal-field.
"	Schlotheimii, . . .	Dromagh Colliery, Kanturk.
"	"	Annagher Colliery, Coal Island.
Neuropteris	acuminata, ...	Annagher Colliery, Coal Island.
"	gigantea, ...	Annagher Colliery, Coal Island.
"	rotundifolia, . . .	Annagher Colliery, Coal Island.
"	tenuifolia, ...	Annagher Colliery, Coal Island.
Odontopteris	obtusa, ...	Annagher Colliery, Coal Island.
Pecopteris	muricata, ...	Annagher Colliery, Coal Island.
"	lonchitica, ...	Dromagh Colliery, Kanturk.
"	polymorpha, . . .	Aghabehy, Keadue.
"	Serlii, ...	Annagher Colliery, Coal Island.
"	"	Dromagh Colliery, Kanturk.
LYCOPODIACEÆ.		
Lepidodendron	aculeatum, ...	Ballycastle Colliery, Co. Antrim.
"	dilatatum, ...	Crosshill, Keadue.
"	elegans, ...	Dromagh & Gurteen Collieries, Kanturk.
"	"	Crosshill and Aghabehy, Keadue.
"	Harcourtii, ...	Ballycastle Collieries, Co. Antrim.
"	obovatum, ...	Aghabehy, Keadue.
"	rimosum, ...	Dromagh Colliery, Kanturk.
"	selaginoides, ...	Dromagh Colliery, Kanturk.
"	Sternbergii, ...	Dromagh Colliery, Kanturk.
Ulodendron	minus, ...	Dromagh Colliery, Kanturk.
"	"	Gurteen Colliery, Kanturk.

TABLE SHOWING THE DISTRIBUTION OF THE FOSSILS THROUGHOUT THE SEVERAL MEMBERS OF THE CARBONIFEROUS SYSTEM BELOW THE COAL SERIES.

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.*
Mollusca or Heterogan-gangliata.		*	*	*	*	*	*	*
Cephalopoda.		. .	*	*	*	*	*	*
Siphonifera or Tetra-branchiata.		. .	*	*	*	*	*	*
Orthoceratidæ.		. .	*	*	*	*	*	*
Orthoceras	attenuatum, .	. .	*	*	. .	*	*	*
"	cinctum, . .	. .	. .	. .	. .	*	*	. .
"	cylindraceum,	. .	. .	. .	*	*	. .	*
"	filiferum, . .	. .	. .	. .	*	. .	. .	. .
"	mucronatum, .	. .	. .	. .	. .	. .	*	. .
"	ovale, ...	. .	. .	. .	. .	*	. .	. .
"	pyramidale, .	. .	. .	. .	. .	*	. .	*
"	striatum, . .	. .	. .	. .	. .	*	. .	. .
Loxoceras	Breynii, . . .	. .	. .	. .	. .	*	. .	*
"	distans, . . .	. .	. .	. .	. .	*	. .	. .
"	incomitatum, .	. .	. .	. .	*	. .	. .	. .
"	laterale, . . .	. .	. .	. .	*	*	*	*
Campyloceras	arcuatum, . .	. .	. .	. .	. .	. .	. .	*
"	unguis, . . .	. .	. .	. .	. .	*	. .	. .
Cycloceras	annulare, . .	. .	. .	. .	. .	. .	. .	*
"	lævigatum, .	. .	. .	. .	. .	*	. .	. .
"	lineolatum, .	. .	. .	. .	. .	. .	. .	*
Poterioceras	fusiforme, . .	. .	. .	. .	. .	*	. .	. .
"	ventricosum, .	. .	. .	. .	. .	*	. .	. .
Actinoceras	giganteum, .	. .	*	. .	. .	*	. .	. .
"	pyramidatum,	. .	*	. .	. .	. .	. .	. .
Cyrtoceras	tuberculatum,	. .	*	. .	. .	*	*	. .
Phragmoceras	flexistria, . .	. .	. .	*	. .	. .	. .	. .
Nautilidæ.		*	*	*	*	*	*	*
Goniatites	discus, . . .	. .	. .	. .	. .	*	. .	. .
"	excavatus, . .	. .	. .	. .	. .	*	. .	*
"	fasciculatus, .	. .	. .	. .	. .	*	. .	. .
"	Gibsoni, . . .	. .	. .	. .	*	. .	*	. .
"	intercostalis, .	. .	*	. .	. .	*	. .	. .
"	latus, ...	. .	. .	. .	. .	*	. .	. .
"	Listeri, . . .	. .	. .	. .	. .	*	. .	. .
"	micronotus, .	. .	. .	. .	. .	*	. .	. .
"	mutabilis, . .	. .	. .	. .	. .	*	. .	. .
"	obtusus, . . .	. .	. .	. .	. .	*	. .	*

* The above contractions are as follow:—Y. Sand., Yellow Sandstone; Ar. Li., Arenaceous Limestone; Ar. Sh., Arenaceous Shale; Carb. Sl., Carboniferous Slate; Lower Li., Lower Limestone; Mid. Li., Middle Limestone; Upper Li., Upper Limestone.

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp. or Mid. Li.	Upper Li.
Goniatites	ovatus, . . .	. .	. .	. .	. .	*	. .	. .
,,	reticulatus, . .	. .	*	. .	. .	. .	. .	. .
,,	sphæroidalis, .	. .	. .	. .	. .	*	. .	. .
,,	striatus, . . .	. .	. .	. .	*	.	. .	. .
,,	striolatus, . .	. .	. .	. .	*	*	. .	*
,,	truncatus, . .	. .	. .	. .	. .	*	. .	. .
Clymenia	sagittalis, . .	. .	. .	*	. .	. .	. .	. .
Discites	costellatus, . .	. .	. .	. .	. .	*	. .	. .
,,	discors, . . .	. .	. .	. .	. .	*	. .	. .
,,	latidorsatus, .	. .	. .	. .	. .	*	. .	. .
,,	mutabilis, . .	. .	. .	. .	. .	. .	. .	*
,,	oxystomus, . .	. .	. .	. .	*	. .	. .	. .
,,	planotergatus, .	. .	. .	. .	. .	*	. .	. .
,,	subsulcatus, . .	. .	. .	. .	. .	*	. .	. .
,,	sulcatus, . . .	. .	*	. .	*	*	. .	. .
,,	tetragonus, . .	. .	. .	*	*	. .	. .	. .
,,	trochlea, . . .	. .	. .	. .	. .	*	. .	. .
Temnocheilus	biangulatus, .	. .	. .	*	. .	*	. .	. .
,,	cariniferus, . .	. .	. .	. .	. .	*	. .	. .
,,	coronatus, . .	. .	. .	. .	. .	*	. .	. .
,,	costalis, . . .	. .	. .	. .	. .	*	. .	. .
,,	crenatus, . . .	. .	. .	. .	. .	*	. .	. .
,,	furcatus, . . .	. .	. .	. .	. .	*	. .	. .
,,	globatus, . .	. .	. .	. .	. .	. .	. .	*
,,	multicarinatus,	. .	. .	. .	. .	*	. .	. .
,,	pinguis, . .	. .	. .	. .	. .	*	. .	. .
,,	porcatus, . .	. .	. .	. .	*	. .	. .	. .
,,	sulciferus, . .	. .	. .	. .	. .	*	. .	. .
,,	tuberculatus, .	. .	*	. .	. .	*	. .	.
Nautilus	cyclostomus, .	. .	. .	. .	. .	*	. .	*
,,	dorsalis, . .	. .	. .	. .	. .	*	. .	. .
Bellerephon	apertus, . .	. .	*	. .	*	*	. .	. .
,,	cornu-arietis, .	. .	*	. .	*	*	. .	. .
,,	costatus, . .	. .	. .	. .	. .	*	. .	. .
,,	hiulcus, . .	. .	. .	. .	*	*	. .	. .
,,	lævis, . . .	. .	. .	. .	. .	*	. .	. .
,,	obsoletus, . .	. .	. .	. .	. .	*	. .	. .
,,	reticulatus, .	. .	. .	. .	. .	. .	. .	*
,,	tangentialis, .	. .	. .	. .	. .	*	. .	. .
,,	tenuifascia, . .	. .	. .	. .	. .	*	. .	. .
Euphemus	intersectus, .	. .	. .	. .	. .	*	. .	. .
,,	Urii, . . .	. .	. .	. .	. .	*	. .	*
Gasteropoda.		*	*	*	*	*	*	*
Pectinibranchiata.		*	*	*	*	*	*	*
Zoophaga.		*	. .	*	*	*	*	. .
Macrocheilus	acutus, . . .	. .	. .	. .	. .	*	. .	. .
,,	canaliculatus, .	. .	. .	*	. .	. .	. .	. .
,,	curvilineus, .	. .	. .	*	. .	*	. .	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Macrocheilus	imbricatus,					*		
"	fimbriatus,			*				
"	ovalis,			*				
"	parallelus,					*		
"	rectilineus,					*		
Loxonema	brevis,					*		
"	constricta,				*	*		
"	impendens,					*		
"	polygyra,			*		*		
"	pulcherrima,				*			
"	sulcatula,	*						
"	sulculosa,				*	*	*	
"	tumida,			*	*	*		
Phytophaga.			*	*	*	*	*	*
Turritella	acicula,			*				
"	megaspira,					*		
"	suturalis,					*		*
"	tenuistria,		*			*		
Turbo	spirata,		*					
Lacuna	antiqua,						*	
Naticopsis	canaliculata,					*		
"	dubia,					*		
"	elongata,		*			*		
"	neritoides,					*		
"	Phillipsii,					*		*
"	plicistria,				*	*		
"	spirata,		*					*
Euomphalus	acutus,			*	*	*		
"	æqualis,				*	*		
"	anguis,					*		
"	calyx,			*		*	*	
"	catillus,		*	*				
"	cristatus,					*		
"								
"	crotalostomus,					*	*	
"	elongatus,		*					
"	marginatus,		*					
"	neglectus,					*		
"	pentangulatus,		*	*		*	*	
"	pileopsideus,					*		
"	quadratus,			*				
"	rotundatus,		*		*	*		
"	serpens,			*	*			
"	tabulatus,		*	*	*	*		
Platyschisma	Cirroides,					*		
"	Helicoides,					*		
"	Jamesii,					*		
"	zonites,					*		
Pleurotomaria	altavittata,			*				

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Pleurotomaria	canaliculata,			*	*	*		
"	carinata,				*	*		
"	concentrica,				*	*		
"	conica,				*			
"	decussata,					*		
"	filosa,					*		
"	Griffithii,					*		
"	Hainesii,					*		
"	lenticula,					*		
"	multicarinata,					*		
"	tornatilis,				*			
Murchisonia	elongata,			*				
"	Larçomi,			*				
"	quadricarinata,							*
Elenchus	antiquus,			*				
"	subulatus,					*		
Scutibranchia and Cyclobranchia.				*	*	*	– *	*
Trochella	prisca,					*		
Fissurella	elongata,				*			
Dirinus	Bucklandi,						*	
Acroculia	angustata,					*		
"	canaliculata,					*		
"	carinata,					*		
"	sigmoidalis,			*				
"	triloba,				*	*		
"	tubifer,				*	*		
"	vetusta,				*	*		*
Patella	mucronata,			*		*		
"	scutiformis,				*	*		
"	sinuosa,					*	*	
Siphonaria	Konincki,					*		
Umbrella	lævigata,					*		
Dentalium	inornatum,					*		
Dythyra.		*	*	*	*	*	*	*
Macrotrachia.		*	*	*	*	*	*	*
Teredo (?)	antiqua,		*					
Solenopsis	minor,							*
Sanguinolites	angustatus,		*	*	*		*	
"	arcuatus,		*			*		
"	contortus,					*		
"	costellatus,			*				
"	curtus,						*	
"	discors,			*				
"	Iridinoides,				*		*	*
"	plicatus,		*	*	*		*	
"	radiatus,							*

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Sanguinolites,	sulcatus,		*			*		
„	transversus,	*		*				
„	tricostatus,		*					
„	tumidus,					*		
„	undatus,			*				
Anatina	attenuata,		*					
„	deltoida,		*					
Pandora	clavata,				*			
Edmondia (?)	compressa,					*		
Lutraria	prisca,					*		*
Mactra	incrassata,					*		
„	ovata,		*					
Kellia	gregaria,			*				
Psammobia	decussata,					*		
Lucina	antiqua,						*	
Ungulina	„						*	
Amphidesma	subtruncatum,					*	*	
Corbis	cancellata,					*		
Venus	centralis,			*				
„	tenuistria,				*			
Pullastra	bistriata,				*			
„	crassistria,		*					
„	elliptica,			*	*			
„	ovalis				*			
Astarte	gibbosa,			*				
„	quadrata,				*			
Cyprina	Egertoni,		*	*		*		
Donax	primigenius,					*		
Cardium	orbiculare,					*		
Cardiomorpha	Axiniformis,					*		
„	corrugata,					*		
„	oblonga,					*		
„	ventricosa,					*		
Pleurorhynchus	aliformis,				*			
„	armatus,				*			
„	fusiformis,				*			
„	giganteus,		*		*		*	
„	Hibernicus,					*		
„	inflatus,					*		
„	minax,			*	*	*	*	
„	nodulosus,						*	
„	trigonalis,				*	*		
Cypricardia	alata,		*	*				
„	concinna,			*				
„	cuneata,		*					*
„	cylindrica,		*					
„ (? Sedgwickia)	minima,		*					
„	modiolaris,		*					
„	oblonga,		*					

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Cypricardia	quadrata, .	. .	*	. .	. .	. .	. .	. .
"	rhombea, . .	. .	. .	. .	*	. .	. .	. .
"	sinuata, . . .	. .	*	. .	. .	. .	. .	. .
"	socialis, . . .	. .	. .	*	. .	. .	. .	. .
"	subtruncata, .	. .	. .	. .	. .	. .	*	. .
"	tumida, . . .	. .	. .	*	. .	. .	. .	. .
Sedgwickia	attenuata, . .	. .	. .	*	. .	. .	. .	. .
"	bullata, . . .	. .	. .	*	. .	. .	. .	. .
"	gigantea, . .	. .	. .	. .	*	. .	. .	. .
"	globosa, . . .	. .	. .	*	. .	. .	. .	. .
Axinus	axiniformis, .	. .	. .	*	. .	. .	. .	. .
"	carbonarius, .	. .	. .	*	. .	. .	. .	. .
"	centralis, . .	*	. .	. .	. .	. .	. .	. .
"	deltoideus, . .	. .	. .	*	. .	. .	. .	. .
"	nuculoides, . .	. .	. .	*	. .	. .	. .	. .
"	obliquus, . .	. .	. .	*	. .	. .	. .	. .
"	obovatus, . .	. .	. .	*	. .	. .	. .	. .
Delabra	attenuata, . .	. .	. .	. .	*	. .	. .	. .
"	equilateralis, .	. .	. .	. .	*	. .	. .	. .
"	gregaria, . .	. .	. .	*	. .	. .	. .	. .
"	orbicularis, . .	*	. .	. .	. .	. .	. .	. .
"	rectangularis, .	. .	. .	. .	. .	. .	*	. .
"	securiformis, .	. .	. .	*	. .	. .	. .	. .
Leptodomus	fragilis, . . .	. .	. .	. .	. .	*	. .	. .
"	senilis, . . .	. .	. .	. .	. .	*	. .	. .
Venerupis	cingulatus, . .	. .	. .	. .	. .	*	. .	. .
"	obsoletus, . .	. .	. .	. .	. .	*	. .	. .
"	scalaris, . .	. .	. .	. .	. .	*	. .	. .
Atrachia.		*	*	*	*	*	*	*
Nucula	attenuata, . .	. .	. .	. .	*	. .	*	*
"	birostrata, . .	. .	. .	. .	*	. .	. .	. .
"	brevirostris, .	. .	. .	. .	*	. .	. .	. .
"	carinata, . .	. .	. .	. .	*	. .	. .	. .
"	clavata, . . .	. .	. .	*	. .	. .	. .	. .
"	cylindrica, . .	. .	*	. .	. .	. .	*	. .
"	gibbosa, . .	. .	. .	*	*	. .	. .	. .
"	leiorynchus, .	. .	. .	*	. .	. .	. .	. .
"	longirostris, .	. .	. .	*	. .	. .	. .	. .
"	oblonga, . .	. .	. .	*	. .	. .	. .	. .
"	Phillipsii, . .	. .	. .	*	*	. .	*	. .
"	rectangularis, .	. .	. .	. .	*	*	. .	. .
"	stilla, . . .	. .	. .	*	. .	. .	. .	. .
"	unilateralis, .	. .	. .	. .	*	. .	. .	. .
Arca	cancellata, . .	. .	. .	. .	. .	. .	. .	*
"	fimbriata, . .	. .	. .	. .	. .	*	. .	. .
Cucullæa	arguta, . . .	. .	. .	. .	. .	*	. .	*
"	tenuistria, . .	. .	. .	*	. .	*	. .	. .
Byssoarca	clathrata, . .	. .	. .	. .	. .	. .	*	. .
"	costellata, . .	. .	. .	. .	. .	. .	. .	*

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Byssoarca	lanceolata,	. .	. .	. .	*	. .	. .	. .
”	obtusa,	. .	. .	. .	. .	*	. .	. .
”	reticulata,	. .	. .	. .	. .	*	*	*
”	semicostata,	. .	. .	. .	. .	. .	*	. .
Crenella	acutirostris,	. .	. .	*	. .	. .	. .	. .
Modiola	amygdalina,	. .	. .	. .	*	. .	. .	. .
”	concinna,	. .	*	. .	. .	. .	. .	. .
”	divisa,	. .	. .	*	. .	. .	. .	. .
”	lingualis,	. .	. .	*	. .	. .	. .	. .
”	Macadami,	. .	. .	*	. .	. .	. .	. .
”	megaloba,	*	. .	. .	. .	. .	. .	. .
”	patula,	. .	. .	. .	. .	*	. .	. .
”	subparallela,	. .	*	. .	. .	. .	. .	. .
Lithodomus	dactyloides,	. .	. .	. .	. .	*	. .	. .
Lanistes	obtusus,	. .	. .	. .	. .	. .	. .	*
Mytilus	comptus,	. .	. .	. .	*	. .	. .	. .
”	Flemingi,	. .	. .	. .	. .	*	. .	. .
Inoceramus	lævissimus,	. .	. .	. .	. .	*	. .	. .
”	orbicularis,	. .	. .	. .	. .	*	. .	. .
”	pernoides,	. .	. .	. .	. .	*	. .	. .
”	vetustus,	*	. .	. .	. .	*	. .	*
Posidonia	Becheri,	. .	. .	. .	. .	. .	*	. .
”	costata,	. .	. .	. .	. .	. .	*	. .
”	lateralis,	. .	. .	. .	. .	. .	*	. .
”	membranacea,	. .	. .	. .	. .	. .	*	. .
”	similis,	. .	. .	. .	. .	. .	*	. .
”	tuberculata,	. .	. .	. .	. .	. .	*	. .
Meleagrina	lævigata,	. .	. .	. .	. .	*	. .	. .
”	pulchella,	. .	. .	. .	. .	*	. .	. .
”	quadrata,	. .	. .	. .	. .	*	. .	*
”	radiata,	. .	. .	. .	. .	*	. .	*
”	rigida,	. .	. .	. .	*	. .	. .	. .
”	tessellata,	. .	. .	. .	*	. .	. .	*
Pteronites	angustatus,	. .	. .	*	*	. .	. .	. .
”	latus,	. .	. .	. .	. .	*	. .	. .
”	semisulcatus,	. .	. .	. .	. .	. .	. .	*
”	sulcatus,	. .	. .	. .	. .	. .	*	. .
”	ventricosus,	*	. .	. .	. .	. .	. .	. .
Avicula	angusta,	. .	. .	*	. .	. .	. .	. .
”	cycloptera,	. .	. .	. .	*	. .	. .	. .
”	flabellulum,	. .	. .	. .	. .	. .	*	. .
”	gibbosa,	. .	. .	. .	. .	. .	. .	*
”	informis,	. .	*	. .	. .	. .	. .	. .
”	laminosa,	. .	. .	*	. .	*	*	. .
”	lævigata,	. .	. .	. .	. .	*	. .	. .
”	lunulata,	. .	. .	. .	. .	*	. .	. .
”	recta,	. .	. .	. .	. .	*	. .	. .
”	squamosa,	. .	. .	. .	. .	. .	*	. .
”	Thompsoni,	. .	. .	. .	*	. .	. .	. .
”	Verneuillii,	. .	. .	*	. .	. .	. .	. .
Pinna	flabelliformis,	. .	. .	. .	. .	*	. .	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Pinna	flexicostata, .	. .	. .	. .	*	. .	. .	. .
"	inequicostata, .	. .	. .	. .	. .	. .	*	. .
"	mutica . . .	. .	*	. .	. .	. .	. .	. .
Lingula	squamiformis ?	. .	. .	*	. .	. .	. .	. .
Anomia	antiqua, . .	. .	. .	. .	. .	*	. .	. .
Malleus	orbicularis, . .	. .	. .	. .	*	. .	. .	. .
Lima	alternata, . .	. .	. .	. .	. .	*	. .	*
"	concinna, . .	. .	*	. .	. .	. .	. .	. .
"	decussata, . .	. .	. .	. .	. .	. .	. .	*
"	lævigata, . .	. .	. .	. .	. .	*	. .	*
"	obliqua, . .	. .	. .	. .	. .	. .	*	. .
"	planicostata, .	. .	. .	*	. .	. .	. .	. .
"	prisca, . . .	. .	. .	. .	. .	*	. .	. .
"	semisulcata, .	. .	. .	. .	. .	. .	*	. .
Pecten	æqualis, . .	. .	. .	. .	. .	. .	. .	*
"	arachnoideus, .	. .	. .	. .	*	. .	. .	. .
"	arenosus, . .	. .	. .	. .	. .	*	. .	*
"	asperulus, . .	. .	. .	. .	. .	. .	. .	*
"	bellis, . . .	. .	. .	. .	*	. .	. .	. .
"	cancellatulus, .	. .	. .	. .	. .	. .	. .	*
"	cingendus, . .	. .	. .	. .	. .	. .	*	. .
"	clathratus, . .	. .	. .	. .	. .	*	. .	. .
"	cælatus, . .	. .	. .	. .	. .	*	. .	. .
"	concavus, . .	. .	*	. .	. .	. .	. .	. .
"	concentrico-striatus,	. .	. .	. .	. .	*	. .	*
"	conoideus, . .	. .	*	. .	. .	. .	. .	. .
"	consimilis, . .	. .	. .	. .	*	. .	. .	. .
"	deornatus, . .	. .	. .	. .	. .	*	. .	. .
"	depilis, . . .	. .	*	. .	. .	. .	*	. .
"	dissimilis, . .	. .	. .	. .	. .	*	. .	. .
"	duplicicosta, .	. .	. .	*	. .	. .	. .	. .
"	ellipticus, . .	. .	*	*	*	*	*	*
"	elongatus, . .	. .	. .	. .	. .	*	. .	. .
"	fallax, . . .	. .	. .	. .	*	*	. .	. .
"	filatus, . . .	. .	. .	*	. .	*	. .	. .
"	flabellulum, .	. .	. .	. .	. .	. .	. .	*
"	flexuosus, . .	. .	. .	. .	. .	*	. .	. .
"	Forbesii, . .	. .	. .	. .	. .	*	. .	. .
"	gibbosus, . .	. .	. .	. .	. .	*	. .	*
"	granosus, . .	. .	. .	. .	*	*	. .	*
"	granulosus, .	. .	. .	. .	*	. .	*	*
"	Hardingii, . .	. .	. .	. .	*	. .	. .	. .
"	hians, . . .	. .	. .	. .	. .	*	. .	. .
"	incrassatus, .	. .	. .	. .	*	. .	. .	. .
"	intercostatus, .	. .	. .	. .	. .	*	. .	*
"	insterstitialis, .	. .	. .	*	*	. .	*	*
"	irregularis, . .	. .	. .	. .	*	. .	. .	. .
"	Jonesii, . . .	. .	. .	. .	. .	. .	. .	*
"	Knockonniensis	. .	*	. .	. .	. .	. .	. .
"	macrotis, . .	. .	. .	*	. .	. .	. .	. .
"	megalotis, . .	. .	. .	. .	*	. .	*	*

Names of Fossils.		Yellow Sandstone Group				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Pecten	micropterus, .	. .	. .	*	. .	. .	. .	. .
"	mundus, . .	. .	. .	. .	*	*	. .	. .
"	Murchisonii, .	. .	. .	. .	*	*	. .	. .
"	ovatus, . . .	. .	. .	. .	. .	*	. .	. .
"	pera, . . .	. .	. .	*	. .	. .	. .	. .
"	planicostatus, .	. .	. .	. .	. .	*	. .	. .
"	plano-clathratus	. .	. .	. .	.	. .	*	. .
"	plicatus, . .	. .	. .	. .	*	*	*	. .
"	polytrichus, .	. .	. .	*	. .	. .	*	. .
"	quinquelineatus	. .	. .	. .	*	. .	. .	. .
"	rugulosus, . .	. .	. .	. .	*	. .	. .	. .
"	scalaris, . .	. .	. .	. .	*	. .	. .	. .
"	sclerotis, . .	. .	. .	. .	. .	. .	*	. .
"	Sedwickii, . .	. .	. .	. .	. .	*	. .	. .
"	segregatus, .	. .	. .	. .	. .	. .	*	. .
"	semicircularis, .	. .	. .	*	*	. .	. .	. .
"	semistriatus, .	. .	. .	. .	. .	*	. .	. .
"	serratus, . .	. .	. .	. .	*	. .	. .	. .
"	simplex, . .	. .	. .	*	. .	. .	. .	. .
"	Sowerbii, . .	. .	. .	*	*	*	*	. .
"	spinulosus, . .	. .	. .	*	. .	. .	. .	. .
"	tabulatus, . .	. .	. .	. .	. .	. .	*	. .
"	transversus, .	. .	. .	. .	*	. .	. .	. .
"	tripartitus, . .	. .	. .	. .	. .	. .	. .	*
"	undulatus, . .	. .	. .	. .	*	. .	. .	. .
"	variabilis, . .	. .	. .	. .	. .	. .	*	. .
Monotis	æqualis, . .	. .	. .	*	. .	. .	. .	. .
Brachiopoda.		*	*	*	*	*	*	*
Orbiculidæ.		*	*	*	*	*	*	*
Orbicula	nitida, . . .	. .	. .	. .	. .	. .	*	. .
"	quadrata, . .	. .	. .	*	. .	. .	. .	. .
"	trigonalis, . .	. .	. .	. .	*	. .	. .	. .
Athyridæ.		*	*	*	*	*	*	*
Crania	vesiculosa, . .	. .	. .	. .	. .	*	. .	. .
Calceola	sandalina, . .	. .	. .	. .	. .	*	. .	. .
Producta	aculeata, . .	. .	*	. .	*	*	*	*
"	antiquata, . .	. .	. .	. .	*	*	*	. .
"	aurita, . . .	. .	. .	. .	. .	*	. .	. .
"	caperata, . .	. .	. .	*	*	. .	. .	. .
"	concinna, . .	. .	. .	*	*	*	*	*
"	corrugata, . .	. .	. .	*	*	*	*	*
"	costellata, . .	. .	. .	. .	. .	. .	. .	*
"	Edelburgensis, .	. .	. .	. .	. .	*	. .	*
Producta	elegans, . .	. .	. .	*	. .	*	*	*
"	fimbriata, . .	. .	*	. .	*	*	*	. .
"	flexistria, . .	. .	. .	. .	. .	*	. .	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Producta	fragaria, . .	..	..	..	*	*	..	..
”	gigantea, . .	..	*	..	..	*	..	*
”	granulosa, . .	..	..	..	*	*	*	*
”	hemispherica, .	..	*	..	*	*	*	..
”	intermedia, .	..	..	..	..	*	..	..
”	interrupta, . .	..	..	..	*	..	..	..
”	laciniata, . .	..	..	..	..	*	..	..
”	latissima, . .	..	..	..	*	*	*	*
”	laxispina, . .	..	*	..	..	*	..	*
”	lirata, . . .	..	..	..	..	*	..	..
”	lobata, . . .	..	..	*	*	..	*	..
”	longispina, . .	..	..	..	*	..	*	..
”	margaritacea, .	..	..	*	*	*	*	..
”	Martini, . .	..	..	..	*	*	*	*
”	maxima, . .	..	..	..	..	*	..	..
”	membranacea, .	..	..	..	*	..	*	..
”	mesoloba, . .	..	..	..	*	*	..	*
”	muricata, . .	..	..	..	..	*	..	..
”	ovalis, . . .	..	..	..	*	*	*	..
”	pectinoides, .	..	..	..	*	*	*	*
”	prælonga, . .	*	..	..	*	..	..	..
”	pugilis, . . .	..	..	..	*	*	*	*
”	punctata, . .	..	*	..	*	*	*	*
”	pustulosa, . .	..	..	..	*	*	..	*
”	quincuncialis, .	..	..	*	*	*	*	*
”	rugata, . . .	..	..	..	*	*	*	*
”	scabricula, . .	..	..	*	*	*	*	*
”	Scotica, . . .	..	*	*	*	*	*	*
”	setosa, . . .	*	..	*	*	*	*	*
”	spinosa, . . .	..	..	*	*	*	*	*
”	striata, . . .	..	..	..	..	*	..	..
”	sublævis, . .	..	..	..	..	*	..	..
”	sulcata, . . .	..	..	*	*	*	*	*
”	tortilis, . . .	..	*	..	..	..	..	..
Leptagonia	analoga, . .	..	..	..	*	*	*	*
”	depressa, . .	..	..	..	..	..	..	..
”	multirugata, .	..	..	..	..	*	..	..
”	nodulosa, . .	..	..	..	*	..	..	..
”	plicatilis, . .	..	..	..	*	*	..	*
”	rugosa, . . .	..	..	..	*	...	..	..
Leptæna	sp. ?	..	..	..	..	*	..	..
”	convoluta, . .	..	..	..	*	..	*	..
”	crassistria, . .	..	..	..	..	..	*	..
”	Dalmaniana, .	..	..	..	*	..	..	..
”	Hardrensis, .	..	..	*	*	*	*	*
”	lata ? . .	..	..	*	..	..	..	..
”	multidentata, .	..	..	*	*	..	..	..
”	papyracea, . .	..	..	..	..	..	*	..
”	perlata, . . .	..	..	..	*	..	..	..
”	plicata, . . .	..	..	..	*	..	..	..
”	sericea? . . .	..	..	..	*	..	..	..

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Leptæna	serrata, . . .	...	..	..	..	*	..	..
”	sordida, . .	..	..	*	*	..	*	..
”	volva, . . .	..	..	..	*	*	*	..
Delthyridæ.		*	*	*	*	*	*	*
Orthis	arachnoidea, .	..	..	..	*	..	..	..
”	arcuata, . .	*	..	..	*	..	*	..
”	Bechei, . . .	..	..	..	*	..	..	..
”	caduca, . . .	..	..	..	*	..	..	..
”	circularis, . .	..	..	..	*	..	..	..
”	comata, . . .	..	..	..	*	..	..	..
”	connivens, . .	..	..	..	..	*	..	..
”	crenistria, . .	*	..	*	*	*	*	*
”	cylindrica, . .	..	*	..	..	..	..	..
”	divaricata, . .	..	..	..	..	*	..	..
”	filiaria, . . .	..	..	*	*	*	*	*
”	gibbera, . .	..	..	..	..	*	..	..
”	granulosa, . .	..	..	*	*	..	..	..
”	interlineata, .	..	..	..	*	..	..	..
”	Kellii, . . .	..	..	..	..	*	..	..
”	latissima, . .	..	..	*	*	..	..	..
”	longisulcata, .	..	..	..	*	*	..	..
”	papilionacea, .	..	..	*	*	*	*	..
”	parallela, . .	..	*	..	*	..	*	..
”	quadrata, . .	..	..	..	..	..	*	..
”	radialis, . .	..	..	..	*	*	*	..
”	resupinata, . .	..	..	*	*	*	*	*
”	semicircularis, .	..	..	*	*	..	*	..
”	sulcata, . . .	..	..	*	..	..	..	..
”	tenuistria, . .	..	..	..	*	..	*	..
”	tuberculata,	..	..	..	..	*	..	..
Spirifera	aperturata, . .	..	..	..	*	..	..	..
”	attenuata, . .	..	..	*	*	*	*	*
”	bisulcata, . .	..	..	*	*	*	*	*
”	calcarata, . .	..	*	*	*	*	*	..
”	choristites, . .	..	..	..	..	*	..	..
”	clathrata, . .	..	..	..	*	..	..	..
”	crispa, . . .	*	..	..	*	*	*	..
”	decemcostata, .	..	..	..	..	*	..	..
”	disjuncta, . .	..	..	*	*	*	..	..
”	gigantea, . .	..	..	..	*	*	*	*
”	grandæva, . .	*	..	..	*	..	..	..
”	inornata, . .	*	..	..	*	..	..	..
”	megaloba, . .	..	..	..	*	..	..	..
”	minima, . .	..	*	..	..	..	..	*
”	octoplicata, .	..	..	*	*	*	*	..
”	Ornithorhyncha	..	..	..	..	*	..	..
”	ostiolata, . .	..	*	*	*	*	*	..
”	princeps, . .	..	..	..	..	*	..	..
”	quinqueloba, .	..	..	..	..	*	..	..

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Spirifera	rhomboidea,	. .	. .	. .	*	*	. .	*
"	rotundata,	. .	. .	. .	*	*	. .	. .
"	rudis,	. .	. .	. .	*	. .	. .	. .
"	speciosa,	. .	. .	*	*	*	*	*
"	striata,	. .	. .	. .	. .	*	. .	. .
"	trigonalis,	. .	. .	. .	. .	*	. .	. .
"	Urii,	. .	. .	. .	*	*	. .	. .
Cyrtia	cuspidata,	. .	. .	. .	*	*	*	. .
"	distans,	. .	. .	*	*	*	*	. .
"	dorsata,	. .	. .	. .	. .	*	. .	. .
"	laminosa,	. .	. .	. .	*	. .	. .	. .
"	linguifera,	. .	. .	*	. .	*	*	*
Cyrtia	mesogonia,	. .	. .	. .	*	. .	. .	. .
"	nuda,	. .	. .	. .	*	. .	. .	.
"	semicircularis,	. .	. .	. .	*	*	. .	*
"	senilis,	. .	. .	. .	. .	*	. .	. .
"	simplex,	. .	. .	. .	*	*	. .	. .
"	subconica,	. .	. .	. .	. .	. .	*	. .
Martinia	decora,	. .	. .	. .	*	*	. .	. .
"	elliptica,	. .	. .	*	*	*	. .	. .
"	glabra,	. .	. .	. .	*	*	*	. .
"	oblata,	. .	. .	. .	. .	*	. .	. .
"	obtusa,	. .	. .	. .	. .	*	. .	. .
"	phalæna,	. .	. .	. .	*	. .	. .	. .
"	plebeia,	. .	*	. .	*	*	*	*
"	rhomboidalis,	. .	. .	. .	. .	*	. .	. .
"	strigocephaloides,	. .	. .	. .	*	. .	. .	. .
"	symmetrica,	. .	. .	. .	. .	*	. .	. .
Reticularia	imbricata,	. .	. .	. .	*	*	*	*
"	lineata,	. .	. .	. .	*	*	. .	. .
"	microgemma,	. .	. .	. .	*	. .	*	. .
"	reticulata,	. .	. .	. .	. .	*	. .	*
"	striatella,	. .	*	. .	. .	. *	. .	. .
Brachythyris	duplicicosta,	. .	. .	*	*	*	*	. .
"	exarata,	. .	. .	. .	. .	*	*	*
"	integricosta,	. .	. .	. .	*	*	*	. .
"	ovalis,	. .	. .	. .	*	*	. .	. .
"	pinguis,	. .	. .	. .	*	*	*	*
"	planata,	. .	. .	. .	*	. .	*	. .
"	planicostata,	. .	. .	*	. .	*	. .	*
Athyris	concentrica,	. .	. .	*	*	. .	*	. .
"	decussata,	. .	. .	*	*	*	*	. .
"	depressa,	. .	. .	. .	*	. .	. .	. .
"	expansa,	. .	. .	. .	. .	*	*	. .
"	fimbriata,	. .	. .	. .	*	*	*	*
"	glabristria,	. .	. .	*	*	*	*	. .
"	globularis,	. .	*	. .	*	*	. .	*
"	hispida,	. .	. .	. .	*	. .	. .	. .
"	plano-sulcata,	. .	. .	. .	*	*	. .	. .
"	squamosa,	. .	. .	. .	*	*	. .	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sil.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Athyris ?	triloba, . . .	. .	*	. .	. .	. .	. .	. .
Actinoconchus	paradoxus, . .	. .	. .	. .	. .	*	. .	*
TEREBRATULIDÆ.		*	*	*	*	*	*	*
Atrypa	acuminata, . .	. .	. .	. .	. .	*	. .	. .
”	angularis, . .	. .	. .	*	. .	. .	. .	. .
”	anisodonta, . .	. .	. .	. .	. .	*	. .	. .
”	bifera, . . .	. .	. .	. .	. .	*	. .	. .
”	compta, . . .	. .	. .	*	. .	. .	. .	. .
”	cordiformis, .	. .	. .	. .	. .	*	. .	. .
”	desquamata, .	. .	. .	. .	*	. .	. .	. .
”	excavata, . .	. .	. .	. .	. .	*	. .	. .
”	fallax, . . .	*	. .	*	*	. .	*	. .
”	ferita, . . .	. .	. .	. .	. .	*	. .	. .
”	flexistria, . .	. .	. .	. .	*	. .	. .	*
”	gregaria, . .	. .	*	. .	. .	. .	. .	. .
”	hastata, . . .	. .	. .	*	*	*	*	*
”	indentata, . .	. .	*	. .	. .	. .	. .	. .
”	insperata, . .	. .	. .	. .	*	. .	. .	. .
”	isorhyncha, .	. .	. .	. .	. .	*	. .	. .
”	juvenis, . . .	*	. .	*	*	. .	. .	. .
”	lachryma, . .	. .	. .	. .	*	*	. .	. .
”	laticliva, . .	. .	. .	. .	. .	*	. .	. .
”	laticosta, . .	. .	. .	*	*	. .	. .	. .
”	nana, . . .	. .	. .	. .	*	. .	. .	. .
”	oblonga, . .	. .	. .	. .	*	. .	. .	. .
”	obtusa, . . .	. .	. .	. .	. .	*	. .	. .
”	platyloba, . .	. .	. .	. .	. .	*	. .	. .
”	pleurodon, . .	*	. .	*	*	*	*	*
”	prisca, . . .	. .	. .	. .	*	. .	. .	. .
”	proava, . . .	. .	. .	. .	*	. .	. .	. .
”	pugnus, . . .	. .	. .	. .	*	*	. .	*
”	radialis, . . .	*	. .	*	*	*	. .	. .
”	reniformis, . .	. .	. .	. .	*	*	. .	. .
”	sacculus, . .	. .	. .	*	*	*	. .	*
”	semisulcata, .	. .	. .	. .	. .	. .	*	. .
”	striatula, . .	. .	. .	. .	*	. .	. .	. .
”	sulcirostris, .	. .	. .	*	*	*	*	*
”	triangularis, .	. .	. .	. .	. .	*	. .	. .
”	triplex, . . .	. .	. .	*	. .	. .	. .	. .
”	ventilabrum, .	. .	. .	. .	*	*	*	*
”	virgo, . . .	. .	. .	*	. .	*	. .	. .
Seminula	pentahedra, .	. .	. .	. .	. .	*	*	. .
”	pisum, . . .	. .	. .	. .	. .	*	. .	. .
”	rhomboidea, .	. .	. .	. .	. .	*	. .	*
CRUSTACEA.		. .	*	*	*	*	*	*
Calymene ?	granulata, . .	. .	. .	. .	*	. .	. .	. .
”	lævis, . . .	. .	. .	. .	*	. .	. .	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Calymene	Latreillii,				*			
Griffithides	calcaratus,							*
"	globiceps,					*		
"	obsoletus,		*		*		*	*
Phillipsia	cælata,					*		*
"	Colei,				*			
" ?	discors,					*		
"	gemmulifera,				*	*		
"	Jonesii,					*		
"	Kellii,					*		
"	mucronata,				*			
"	quadriserialis,					*		
"	truncatula,				*	*		
Dithyrocaris	Colei,			*				
"	Scouleri,			*				
"	tenuistriatus,					*		
Entomoconchus	Scouleri,					*		*
Bairdia	curtus,			*				
Cythere	arcuata,			*				
"	bituberculata,			*				
"	cornuta,			*				
"	costata,			*				
"	elongata,			*				
"	excavata,			*				
"	gibberula,						*	
"	Hibbertii,		*					
"	impressa,			*				
"	inflata,					*		
"	inornata,			*				
"	oblonga,			*				
"	orbicularis,				*			
"	pusilla,						*	
"	scutulum,						*	
"	subrecta,		*					
"	trituberculata,			*				
Tubicola.			*	*	*		*	
Annulosa.			*	*	*		*	
Annelida.			*	*	*		*	
Serpula	compressa,						*	
"	hexicarinata,						*	
"	parallela,						*	
"	scalaris,				*			
Spirorbis	caperatus,				*			
"	globosus,		*				*	
"	intermedius,			*				
"	minutus,			*				
"	omphalodes, ?			*				
Spiroglyphus	marginatus,				*			

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Serpulites	carbonarius, .	. .	. .	. .	. .	. .	*	. .
"	membranaceus,	. .	. .	. .	*	. .	. .	. .
Sabella	antiqua, . .	. .	. .	. .	*	. .	. .	. .
Nematoneura.		*	*	*	*	*	*	*
Echinodermata.		*	*	*	*	*	*	*
Palæchinus	elegans, . . .	. .	. .	. .	*	. .	. .	. .
"	ellipticus, . .	. .	. .	. .	. .	*	. .	. .
"	gigas, . . .	. .	. .	*	*	. .	. .	. .
"	Königii, . .	. .	. .	*	. .	. .	*	. .
"	sphæricus, . .	. .	. .	. .	. .	. .	. .	. .
Echinocrinus	elegans, . .	. .	. .	. .	*	. .	. .	. .
"	glabrispina, .	. .	. .	. .	*	. .	*	. .
"	triserialis, . .	. .	*	. .	.	. .	. .	. .
"	Urii, . . .	. .	. .	*	*	. .	*	*
"	vetustus, . .	. .	. .	. .	*	*	. .	. .
Adelocrinus	histrix, . . .	. .	. .	. .	*	. .	. .	. .
Pentremites	Derbiensis, . .	. .	. .	. .	. .	. .	. .	*
"	ellipticus, . .	. .	. .	. .	. .	. .	. .	*
"	florealis, . .	. .	. .	. .	. .	. .	. .	. .
Platycrinus	contractus, . .	*	. .	. .	. .	. .	. .	. .
"	expansus, . .	. .	. .	. .	. .	. .	*	. .
"	gigas, . . .	. .	. .	. .	*	. .	. .	. .
"	granulatus, .	. .	. .	. .	*	. .	. .	. .
"	interscapularis,	. .	. .	. .	*	. .	. .	. .
"	laciniatus, . .	. .	. .	. .	*	. .	*	. .
"	lævis, . . .	. .	. .	. .	*	. .	. .	. .
"	ornatus, . .	. .	. .	. .	*	. .	. .	. .
"	punctatus, . .	. .	. .	. .	*	. .	. .	. .
"	rugosus, . .	. .	. .	. .	. .	*	. .	. .
"	similis, . .	. .	. .	. .	*	. .	. .	. .
"	triacontadactylus,	. .	. .	. .	*	. .	. .	. .
"	tuberculatus, .	. .	. .	. .	*	. .	. .	. .
Poteriocrinus	gracilis, . .	. .	. .	. .	*	. .	. .	. .
"	impressus, . .	. .	. .	. .	. .	*	. .	. .
Taxocrinus	macrodactylus,	. .	. .	. .	*	. .	. .	. .
"	polydactylus, .	. .	. .	. .	. .	. .	*	. .
Cyathocrinus	ellipticus, . .	. .	. .	. .	*	. .	*	. .
"	geometricus, .	. .	. .	. .	*	. .	. .	. .
"	inequidactylus,	. .	. .	. .	*	. .	. .	. .
"	macrocheirus, .	. .	. .	*	. .	. .	. .	. .
"	megastylus, .	. .	. .	. .	*	. .	. .	. .
"	ornatus, . .	. .	. .	. .	*	. .	. .	. .
"	pinnatus, ? . .	. .	. .	. .	*	*	*	. .
"	planus, . . .	. .	. .	. .	. .	. .	*	. .
"	tuberculatus, .	. .	. .	. .	*	. .	. .	. .
"	variabilis, . .	. .	. .	*	*	. .	*	*
Rhodocrinus (Gilbertsocrinus)	abnormis, . .	. .	. .	. .	. .	*	. .	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp or Mid. Li.	Upper Li.
Rhodocrinus	verus, . . .	. .	. .	. .	*	. .	. .	. .
Actinocrinus	amphora, . .	. .	. .	. .	. .	*	. .	. .
„	constrictus, .	. .	. .	. .	. .	. .	. .	*
„	costus, . . .	. .	. .	. .	. .	. .	. .	*
„	Gilbertsoni, .	. .	. .	. .	*	. .	. .	. .
„	polydactylus, .	. .	. .	. .	*	*	. .	. .
„	pusillus, . .	. .	. .	. .	*	. .	. .	. .
„	tenuistriatus, .	. .	. .	*	*	. .	*	. .
„	tessellatus, . .	. .	. .	. .	*	. .	. .	. .
„	triacontadactylus, . . .	. .	. .	. .	*	*	. .	*
Atocrinus	Milleri, . . .	. .	. .	. .	*	. .	. .	. .
Acrita.		*	*	*	*	*	*	*
ZOOPHYTA.		*	*	*	*	*	*	*
Amplexus	nodulosus, . .	. .	. .	. .	*	. .	. .	. .
„	Sowerbii, . .	. .	. .	. .	*	*	. .	. .
„	tortuosus, . .	. .	. .	. .	*	*	. .	*
Turbinolopsis	bina, ? . . .	. .	. .	*	*	. .	. .	. .
„	Celtica, . . .	. .	. .	. .	*	. .	. .	. .
„	pauciradialis, .	. .	. .	. .	*	. .	. .	. .
„	pluriradialis, .	. .	. .	. .	*	. .	. .	. .
Turbinolia	expansa, . .	. .	. .	. .	. .	*	. .	. .
„	fungites, . .	. .	*	*	*	*	*	
Siphonophyllia	cylindrica, . .	. .	*	. .	*	*	*	. .
Astræa	aranea, . . .	. .	. .	. .	. .	*	. .	. .
„	crenularis, . .	. .	. .	. .	. .	*	. .	. .
„	irregularis, . .	. .	. .	. .	*	. .	. .	. .
„	pentagona, . .	. .	*	. .	. .	. .	. .	. .
Lithostrotion	striatum, . .	. .	*	. .	. .	*	. .	*
Lithodendron	affine, . . .	. .	. .	. .	*	*	*	*
„	cæspitosum, .	. .	. .	. .	*	*	. .	*
„	irregulare, . .	. .	. .	. .	. .	*	. .	. .
„	panciradialis, .	. .	. .	. .	. .	*	. .	. .
„	sexdecimale, .	. .	. .	. .	*	. .	. .	. .
„	sociale, . . .	. .	. .	. .	. .	*	*	. .
Syringopora	bifurcata, . .	. .	. .	. .	*	. .	. .	. .
„	catenata, . .	. .	. .	. .	*	*	. .	. .
„	geniculata, . .	. .	. .	. .	*	*	. .	. .
„	laxa, . . .	. .	*	*	. .	. .	. .	*
„	ramulosa, . .	. .	. .	*	*	. .	. .	. .
Aulopora	campanulata, .	. .	. .	. .	*	. .	. .	. .
„	gigas, . . .	. .	. .	. .	. .	*	. .	. .
Manon	cribrosum, ? .	. .	. .	*	*	. .	. .	. .
Astreopora	antiqua, . .	. .	. .	. .	*	. .	. .	. .
Dictyophyllia	antiqua,	. .	. .	. .	*	. .	. .	. .
Pleurodictyum	problematicum?	. .	. .	. .	*	. .	. .	. .
Favosites	capillaris, . .	. .	. .	. .	. .	*	. .	. .
„	fibrosa, . . .	. .	. .	. .	*	. .	. .	. .
„	Gothlandica, .	. .	. .	. .	. .	*	. .	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Favosites ?	megastoma,				*	*	*	
„ ?	parasitica,					*		
„	polymorpha,				*			
„	septosa,		*					*
„	serialis,				*			
„	spongites,				*	*	*	*
„ (Michelinia)	tenuisepta,				*	*	*	
„	tumida,				*			*
Stromatopora	concentrica,				*			
„	polymorpha,					*		
„	sublitis,					*		
Verticillopora	abnormis, ?				*		*	
„	dubia, ?					*		
Flustra	palmata,						*	
Berenicea	megastoma,				*			
Orbiculites	antiquus,				*			
Millepora	gracilis,				*		*	
„	interporosa,				*			
„ (Pustulopora)	oculata,	*			*		*	
„	rhombifera,				*			
„	similis,	*			*			
„ (Pustulopora)	spicularis,				*			
Tragos	semicirculare,							*
Gorgonia	assimilis,				*			
„	Lonsdaleiana,					*		
„	zic-zac,		*					
Jania	antiqua,				*			
„	bacillaria,				*			
„	crassa,				*	*	*	
Vincularia	dichotoma,					*		*
„	megastoma,							*
„	parallela,				*			*
„	raricosta,							*
Glauconome	bipinnata,				*		*	*
„	gracilis,					*		*
„	grandis,					*		
„	pluma,				*	*	*	*
„	pulcherrima,							*
Ptylopora	macropora,				*			
„	pluma,				*			
Fenestella	antiqua,			*	*	*	*	
„	carinata,				*			
„	crassa,					*		*
„	ejuncida,							*
„	flabellata,			*		*		
„	formosa,				*			*
„	frutex,							*
„	hemispherica,					*		

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y.Sands. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp, or Mid. Li.	Upper Li.
Fenestella	laxa,	. .	. .	. .	*	. .	. .	*
,,	membranacea,	. .	. .	. .	. .	*	. .	. .
,,	Morrisii,	. .	. .	. .	. .	*	. .	. .
,,	multiporata,	. .	. .	. .	*	. .	. .	*
,,	nodulosa,	. .	. .	. .	*	. .	*	*
,,	oculata,	. .	. .	. .	*	. .	. .	. .
,,	plebeia,	. .	. .	. .	*	*	. .	. .
,,	polyporata,	. .	. .	. .	. .	. .	*	*
,,	quadradecimalis,	. .	. .	. .	. .	. .	. .	*
,,	regularis,	. .	. .	. .	*	. .	. .	. .
,,	reticularis,	. .	. .	. .	*	*	*	. .
,,	tenuifila,	. .	. .	*	*	*	*	*
,,	undulata,	. .	*	*	*	*	*	*
,,	varicosa,	. .	. .	. .	. .	. .	. .	*
Hemitrypa	Hibernica,	. .	. .	. .	. .	*	*	*
Ichthyorachis	Newenhami,	. .	. .	. .	. .	*	. .	. .
Polypora	dendroides,	. .	. .	. .	*	. .	. .	. .
,,	marginata,	. .	. .	. .	. .	. .	. .	*
,,	papillata,	. .	. .	. .	. .	. .	. .	*
,,	verrucosa,	. .	. .	. .	. .	. .	. .	*
Retepora	prisca,	. .	. .	. .	*	*	. .	. .
,,	undata,	. –	. .	. .	*	*	. .	. .
Lower Carboniferous Plants.		*	. .	*	*	. .	. .	. .
Fucoides and Ferns, new,		*	. .	*	*	. .	. .	. .
Lepidodendron, new,		. .	. .	. .	*	. .	. .	. .
Cyclostigma	new,	*	. .	. .	. .	. .	. .	. .
Sphenopteris	linearis,	. .	. .	*	. .	. .	. .	. .
,,	Hibernica,	*	. .	. .	. .	. .	. .	. .
Sternbergia	approximata,	. .	. .	*	. .	. .	. .	. .
Stigmaria	ficoides,	*	. .	. .	. .	. .	. .	. .
Fishes.		. .	*	*	*	*	*	. .
Palæoniscus	sp.,	. .	. .	*	. .	. .	. .	. .
Amblypterus	sp.,	. .	. .	*	. .	. .	. .	. .
Psammodus	cornutus, ?	. .	*	. .	*	*	*	. .
,,	porosus,	. .	*	. .	*	. .	*	*
,,	rugosus,	. .	*	. .	. .	. .	. .	. .
Helodus	sp.,	. .	*	. .	. .	. .	. .	. .
,,	mamillaris,	. .	*	. .	. .	*	. .	. .
,,	planus,	. .	. .	*	. .	. .	. .	. .
,,	turgidus,	. .	*	. .	. .	. .	. .	. .
Chomatodus	sp.,	. .	*	. .	. .	. .	. .	. .
Cochliodus	sp.,	. .	. .	. .	*	*	. .	. .
,,	contortus,	. .	. .	. .	. .	*	. .	
,,	gracilis,	. .	. .	. .	. .	*	. .	. .
,,	magnus,	. .	*	. .	. .	*	*	. .

Names of Fossils.		Yellow Sandstone Group.				Limestone Group.		
Genera.	Species.	Y. Sand. Proper.	Ar. Li.	Ar. Sh.	Carb. Sl.	Lower Li.	Calp,or Mid. Li.	Upper Li.
Cladodus	,, ? . .	. .	*	. .	. .	*	. .	.
,,	mirabilis, . .	. .	. .	*	. .	. .	. .	. .
Petalodus	Hastingsiæ, .	. .	*	. .	. .	*	. .	. .
,,	lævissimus, .	. .	*	. .	. .	. .	. .	. .
,, (palatal tritor)	radicans,	. .	*	. .	. .	*	. .	. .
,,	sagittatus, .	. .	*	. .	. .	. .	. .	. .
Ctenacanthus	sp., . . .	. .	. .	*	. .	*	. .	. .
Asteroptychius	ornatus, . .	. .	. .	.	. .	*	. .	. .
Oracanthus	Milleri, . .	. .	. .	*	. .	. .	. .	. .
Onchus	sp., . . .	. .	. .	. .	. .	*	. .	. .
Pæcilodus	sp., . . .	. .	. .	*	. .	. .	. .	. .
,,	Jonesi, . .	. .	*	. .	. .	. .	. .	. .
,,	sublævis, . .	. .	*	. .	. .	*	. .	. .
,,	transversus, .	. .	*	. .	. .	*	. .	. .
Gyracanthus	obliquus, . .	. .	. .	*	. .	. .	. .	. .
,,	new ? . . .	. .	. .	*	. .	. .	. .	. .
,,	tuberculatus, .	. .	. .	*	. .	. .	. .	. .
,,	spines, . . .	. .	. .	*	. .	. .	. .	. .
Holoptychius	sp., . . .	. .	. .	*	. .	. .	. .	. .
,,	Portlocki, . .	. .	. .	*	. .	. .	. .	. .
Phyllolepis	sp., . . .	. .	. .	*	. .	. .	. .	. .
Chelyophorus	Griffithii, . .	. .	. .	*	. .	. .	. .	. .
Isodus	leptognathus, .	. .	. .	*	. .	. .	. .	. .
Psammosteus	granulatus, .	. .	. .	*	. .	. .	. .	. .
,,	vermicularis, .	. .	. .	*	. .	. .	. .	. .

THE FOLLOWING FOSSILS ARE DESCRIBED IN MY SYNOPSIS, THOUGH NOT CONTAINED IN THE CABINETS.

Genera.	Species.	Genera.	Species.
Orthoceras	Steinhaueri.	Bellerophon	Wenlockensis ?
,,	sulcatulum.	Euphemus ?	globatus.
Trigonoceras	paradoxicum.	,,	orbiculus.
Goniatites	Browni.	Conularia	quadrisulcata.
,,	crenistria.	Macrocheilus	sigmilineus.
,,	sphæricus.	,,	tricinctus.
,,	spiralis.	Loxonema	turrita.
,,	vittiger.	Littorina	pusilla.
Clymenia	plurisepta.	Euomphalus	bifrons.
Temnocheilus	bistrialis.	Pleurotomaria	clathrata.
Nautilus	goniolobus.	,,	Helicinoides.

Genera.	Species.	Genera.	Species.
Pleurotomaria	lævis.	Spirifera	bicarinata.
Murchisonia	sulcata.	"	convoluta.
Sanguinolites	liratus.	"	costata.
Lutraria	elongata.	"	extensa.
Pullastra	antiqua.	"	furcata.
"	elegans.	"	fusiformis.*
"	parallela.	"	mesomala.
Sedgwickia	corrugata.	"	pulchella.
Axinus	orbicularis.	"	transiens.
Nucula	delta.	Martinia	mesoloba.
"	linearis.	"	protensa.
Modiola	angusta.	Brachythyris	hemisphærica.
"	scalaris.	"	linguifera.
Lanistes	rugosus.	Atrypa	canalis ?
Inoceramus	auriculatus.	"	sublobata.
Posidonia	complanata.	"	virgoides.
"	sp.	Astacus ?	Phillipsii.
Meleagrina	alternata.	Griffithides	granuliferus.
"	echinata.	"	longiceps.
Pterinea	desquamata.	"	longispinus.
"	intermedia.	Phillipsia	Macoyii.
Avicula	bicostata.	Dithyrocaris	orbicularis.
Lingula	marginata.	Daphnia	primæva.
"	parallela.	Bairdia	gracilis.
Anomia	antiqua.	Cythere	amygdalina.
Pecten	cognatus.	"	sp.
"	comptus.	"	spinigera
"	exiguus.	Palæchinus	sphæricus.
"	inornatus.	Echinocrinus	Munsterianus ?
"	leiotis.	Platycrinus	elongatus.
"	Meleagrinoides.	Cyathocrinus	conicus.
"	orbiculatus.	Actinocrinus	globosus.
Producta	comoides.	"	lævis.
"	spinulosa.	Phillipsocrinus	caryocrinoides.
"	subaculeata.	Lithodendron	coarctatum.
Leptagonia	depressa.	Caunopora	placenta.
Leptæna	gibberula.*	Ceriopora	distans.
Orthis	compressa ?	Ptylopora	flustriformis.
"	orbicularis.	Hemitrypa	oculata.

* Type of sub-genus Fusella includes S. bicarinata and S. rhomboidea.

ARRANGEMENT OF THE FOREGOING FOSSILS UNDER THEIR RESPECTIVE LOCALITIES, POST-TOWNS, AND COUNTIES.

County Antrim.

BALLYCASTLE,

Vicinity of.

Pecten flabellulum.
Orthoceras cylindraceum.
Cycloceras annulare.
Bellerophon reticulatus.
Euphemus Urii.
Nucula attenuata.
Producta Edelburgensis.
,, Martini.
,, scabricula.
,, Scotica.
Leptæna Hardrensis.
Cyrtia semicircularis.
Reticularia reticulata.
Favosites tumida.

County Armagh.

ARMAGH.

Annahugh.

Bellerophon apertus.
,, hiulcus.

Vicinity of.

Bellerophon apertus.
Macrocheilus parallelus.
Naticopsis plicistria.
Elenchus subulatus.
Sanguinolites tumidus.
Producta elegans.
,, sulcata.
Cyrtia senilis.
Martinia oblata.
,, plebeia.
Athyris expansa.
Atrypa hastata.
Actinocrinus triacontadactylus.
Astræa crenularis.
Syringopora geniculata.
Favosites capillaris.

Drummanbeg.

Cladodus mirabilis.

Drummanmore.

Bellerophon apertus.
Producta punctata.
Sanguinolites sulcatus.
Plants.

Farmacaffy or Redbarn.

Pecten cælatus.
Psammodus porosus.
Helodus
,, turgidus.
Chomatodus
Cochliodus magnus.
Cladodus.
Petalodus lævissimus.
,, radicans (palatal tritor).
,, sagittatus.
Petalodus Jonesii.
,, sublævis.
,, transversus.

Kilmore.

Naticopsis elongata.
Producta hemisphærica.
Syringopora laxa.

County Armagh, *continued.*

New Road.

Bellorophon cornu-arietis.
Euomphalus rotundatus.
Favosites septosus.
Pecten flaxuosus.

Tullyard.

Martinia plebeia.
Lithostrotion striatum.
Pecten ellipticus.

LOUGHGALL.

Ballygasey.

Phillipsia Jonesii.
Lithodendron sociale.
Helodus mammillaris.
Cochliodus contortus.
Cochliodus magnus.
Petalodus Hastingsiæ.
,, radicans (palatal tritor).
Ctenacanthus.
Asteroptychius ornatus.
Onchus.
Pæcilodus transversus.

TYNAN.

College Hall.

Naticopsis plicistria.
Platyschisma cirroides
Cladodus.

Enagh.

Fenestella carinata.
Petalodus Hastingsiæ.

County Carlow.

OLD LEIGHLIN.

Vicinity of.

Producta aculeata.
,, costellata.
,, punctata.
,, quincuncialis.
Leptæna Hardrensis.
Orthis filiaria.
Spirifera minima.
Brachythyris exarata.
,, planicostata.

Raheendoran.

Lithostrotion striatum.
Lithodendron cæspitosum.
Favosites septosus.

LEIGHLIN-BRIDGE.

Bannaghagole.

Producta latissima.
Orthis filiaria.
Reticularia reticulata.
Brachythyris planicostata.
Lithostrotion striatum.

County Cavan.

BALLYCONNELL.

Vicinity of.

Pecten granulosus.
Lithodendron affine.

Swanlinbar.

Turbinolia fungites.

Pulgulim or Swanlinbar.

Lithodendron sociale.

CAVAN.

Kilmore.

Pecten fallax.

Swellan.

Naticopsis plicistria.
Orthis papilionacea.
Favosites spongites.

County Cavan, *continued*.

KILLESHANDRA.

Townparks.

Temnocheilus porcatus.
Nucula cylindrica.
Modiola concinna.
Pecten Murchisoni.
Producta mesoloba.
,, quincuncialis.
Orthis papilionacea.
,, resupinata.
Echinocrinus Urii.
Polypora dendroides.

STRADONE.

Countenan.

Euomphalus acutus.
Pecten ellipticus.
,, granulosus.

Laragh.

Producta spinosa.

VIRGINIA.

Clonkeiffy.

Spirifera minima.

County Clare.

CLARE.

Meelick Chapel.

Glauconome grandis.

Derrybryan.

Spirifera calcarata.

TULLA.

Moymore.

Euomphalus tabulatus.

County Cork.

BALLEA.

Killingly.

Fenestella antiqua.

BANTRY.

Blackball Head.

Fenestella antiqua.
Plants.

Gurteenroe.

Fenestella antiqua.

Reendonoughan.

Spirifera disjuncta.

BUTTEVANT.

Ballybeg.

Nautilus cyclostomus.

CASTLEMARTYR.

Castlerichard.

Temnocheilus furcatus.

CARRIGALINE.

Shanbally.

Spirifera grandæva.
Atrypa prisca.
Orthis arachnoidea.
,, tenuistriata.
Spirifera inornata.

Vicinity of.

Naticopsis dubia.
Corbis cancellata.
Producta ovalis.
Orthis crenistria.
Spirifera gigantea.
Martinia elliptica.

County Cork, *continued.*

CHARLEVILLE.

Annagh.

Orthoceras ovale.
Discites mutabilis.

CORK.

Bantyre.

Cucullæa arguta.

Blackrock.

Discites discors.
Modiola patula.
Cyrtia simplex.

Vicinity of.

Plants.
Cyrtoceras tuberculum.
Goniatites discus.
,, obtusus.
Discites planotergatus.
Platyschisma zonites.
Edmondia compressa.
Cardiomorpha ventricosa.
Inoceramus lævissimus.
Cyrtia dorsata.
Martinia rhomboidalis.
Atrypa anisodonta.

Cove or Queenstown.

Loxoceras incomitatum.

Derrylief.

Dolabra attenuata.

Dunally.

Orthis interlineata.
Spirifera calcarata.

Little Island.

Orthoceras striatum.
Loxoceras Breynii.
,, laterale.
Campyloceras unguis.
Goniatites ovatus.
Discites subsulcatus.
,, sulcatus.
Temnocheilus coronatus.
,, multicarinatus.
Nautilus cyclostomus.
,, dorsalis.
Macrocheilus rectilineus.
Euomphalus acutus.
,, pentangulatus.
,, rotundatus.
,, tabulatus.
Pleurotomaria Hainesii.
,, lenticula.
Acroculia vetusta.
Psammobia decussata.
Cardium orbiculare.
Cardiomorpha oblonga.
Pecten clathratus.
,, deornatus.
,, ellipticus.
,, fallax.
,, granosus.
,, intercostatus.
,, planicostatus.
,, Sedgwickii.
,, semistriatus.
Producta concinna.
,, fimbriata.
,, fragaria.
,, hemisphærica.
,, mesoloba.
,, quincuncialis.
,, Scotica.
,, setosa.
Leptagonia plicatilis.
Orthis connivens.
,, resuspinata.
Spirifera calcarata.
,, choristites.
,, disjuncta.
,, rotundata.
Cyrtia cuspidata.
Martinia glabra.
,, obtusa.
,, plebeia.
Reticularia imbricata.
,, lineata.
Athyris glabristria.

COUNTY CORK, *continued.*

Actinoconchus paradoxus.
Atrypa acuminata.
,, cordiformis.
,, platyloba.
,, sacculus.
,, triangularis.
Dythyrocaris tenuistriatus.
Entomoconchus Scouleri.
Amplexus Sowerbii.
Turbinolia expansa.
,, fungites.
Glauconome gracilis.
Fenestella hemisphærica.
,, Morrisii.
,, plebeia.
Hemitrypa Hibernica.

Middleton.

Orthoceras striatum.
Temnocheilus biangulatus.
Nautilus cyclostomus.
Pleurorhynchus Hibernicus.
Leptagonia analoga.
,, multirugata.

Rinniskiddy.

Spirifera grandæva.
Cyrtia nuda.
Atrypa striatula.
Cyathocrinus pinnatus.

DONERAILE.

Castlecreagh.

Orthoceras attenuatum.
Goniatites Listeri.
Bellerophon hiulcus.

Vicinity of.

Orthoceras pyramidale.
Loxoceras laterale.
Cycloceras lineolatum
Goniatites obtusus.

Fortwilliam.

Temnocheilus globatus.

Streamhill.

Loxoceras Breynii.
Naticopsis Phillipsii.

KILDORRERY.

Tankardstown.

Orthoceras cylindraceum.
Goniatites truncatus.
Temnocheilus multicarinatus.
Bellerophon apertus.
Loxonema sulculosa.
Euomphalus calyx.
,, pentangulatus.
Pleurorhynchus Hibernicus.
Pecten Murchisoni.
Producta mesoloba.
,, pustulosa.
,, sulcata.
Orthis crenistria.
Spirifera rhomboidea.
,, striata.
Reticularia lineata.
Fenestella tenuifila.

KILWORTH.

Arraglin Bridge.

Cypricardia alata.
,, cylindrica.
,, oblonga.
,, quadrata.
,, sinuata.

KINSALE.

Old Head of.

Goniatites striolatus.
Posidonia lateralis.
Avicula, sp. new.

YOUGHAL.

Whiting Bay.

Orthis Bechei.
Spirifera disjuncta.

County Donegal.

BALLINTRA.

Greaghs.

Pecten granulosus.
Producta pectinoides.
Fenestella tenuifila.
,, undulata.

Lisnapaste.

Orthoceras filiferum.
Discites tetragonus.
Euomphalus serpens.
Pleurotomaria tornatilis.
Fissurella elongata.
Sanguinolites Iridinoides.
Venus tenuistriata.
Pullastra ovalis.
Pleurorhynchus trigonalis.
Cypricardia rhombea.
Nucula birostrata.
,, carinata.
,, Phillipsii.
,, rectangularis.
,, unilateralis.
Byssoarca lanceolata.
Modiola amygdalina.
,, divisa.
Meleagrina rigida.
Pecten Hardingii.
,, incrassatus.
,, mundus.
,, Murchisoni.
,, semicircularis.
,, serratus.
,, Sowerbii.
,, undulatus.
Orbicula trigonalis.
Producta antiquata.
,, concinna.
,, hemisphærica.
,, longispina.
,, margaritacea.
,, membranacea.
,, pustulosa.
,, scabricula.
,, setosa.
Leptagonia analoga.
Leptæna convoluta.
,, Dalmaniana.
,, Hardrensis.
,, plicata.
,, sericea.
,, sordida.
Orthis circularis.
,, granulosa.
,, interlineata.
Spirifera calcarata.
,, clathrata.
,, crispa.
,, grandæva.
,, rhomboidea.
,, Urii.
Cyrtia cuspidata.
,, simplex.
Martinia plebeia.
,, strigocephaloides.
Brachythyris duplicicosta.
Athyris decussata.
,, hispida.
,, squamosa.
Atrypa reniformis.
Phillipsia Colei.
Serpula scalaris.
Cyathocrinus ellipticus.
,, megastylus.
,, pinnatus.
Actinocrinus tenuistriatus.
Turbinolia fungites.
Pleurodictyum problematicum.
Millepora gracilis.
,, interporosa.
,, rhombifera.
Jania bacillaria.
Glauconome pluma.
Fenestella regularis.
Retepora undata.

BALLYSHANNON.

Ardloughil.

Orthis crenistria.

COUNTY DONEGAL, *continued*.

Abbeybay or Abbeylands.

Pleurorhyncus giganteus.
Pecten cingendus.
Producta concinna.
,, longispina.
,, pectinoides.
Leptagonia analoga.
Orthis filiaria.
,, semicircularis.
Spirifera gigantea.
,, speciosa.
Cyrtia laminosa.
Athyris decussata.
Atrypa pleurodon.
Serpula parallela.
Jania crassa.

BUNDORAN.

Ballintrillick.

Sanguinolites angustatus.
,, Iridinoides.
,, plicatus.
Lucina antiqua.
Cypricardia subtruncata.
Nucula cylindrica.
,, Phillipsii.
Avicula squamosa.
Lima obliqua.
Pecten depilis.
,, ellipticus.
,, granulosus.
,, interstitialis.
,, plicatus.
,, polytrichus.
,, Sowerbii.
,, tabulatus.
Producta corrugata.
,, elegans.
,, fimbriata.
,, hemisphærica.
,, lobata.
,, margaritacea.
,, pectinoides.
,, pugilis.
,, Scotica.
Producta setosa.
,, spinosa.
,, sulcata.
Leptagonia analoga.
Leptæna convoluta.
,, Hardrensis.
Orthis crenistria.
,, quadrata.
,, radialis.
,, resupinata.
,, tenuistriata.
Spirifera bisulcata.
,, crispa.
,, ostiolata.
,, speciosa.
,, Urii.
Cyrtia laminosa.
Martinia glabra.
,, plebeia.
Reticularia imbricata.
Brachythyris duplicicosta.
,, exarata.
,, integricosta.
,, pinguis.
,, planata.
Atrypa fallax.
,, hastata.
,, sulcirostris.
Seminula pentahedra.
Griffithides obsoletus.
Phillipsia gemmulifera.
Cythere gibberula.
,, scutulum.
Serpula parallela.
Echinocrinus Urii.
Taxocrinus polydactylus.
Cyathocrinus variabilis.
Lithodendron sociale.
Favosites ? spongites.
Verticillopora abnormis. ?
Millepora gracilis.
,, oculata.
Fenestella antiqua.
,, nodulosa.
,, polyporata.
,, tenuifila.
,, undulata.

COUNTY DONEGAL, *continued.*

BUNDORAN, *continued.*

Hemitrypa Hibernica.

Pecten megalotis.
Producta pugilis.
,, setosa.
Cyathocrinus variabilis.
Fenestella multiporata.
,, nodulosa.
,, tenuifila.
Hemitrypa Hibernica.

Vicinity of.

Orthoceras attenuatum.
Loxoceras laterale.
Cyrtoceras tuberculatum.
Loxonema sulculosa.
Euomphalus pentangulatus.
Patella sinuosa.
Ungulina antiqua.
Amphidesma subtruncatum.
Pleurorhynchus minax.
Dolabra rectangularis.
Nucula cylindrica.
Byssoarca reticulata.
Avicula flabellulum.
,, laminosa.
Pecten megalotis.
,, plano-clathratus.
,, sclerotis.
,, Sowerbii.
,, variabilis.
Orbicula nitida.
Producta fimbriata.
,, lôngispina.
,, margaritacea.
,, ovalis.
,, punctata.
,, quincuncialis.
,, scabricula.
,, setosa.
,, sulcata.
Leptæna crassistria.
,, Hardrensis.
,, sordida.
,, volva.
Orthis crenistria.
,, papilionacea.
,, parallela.
,, resupinata.
Spirifera attenuata.
,, calcarata.
,, gigantea.
,, octoplicata.
,, ostiolata.
,, speciosa.
Cyrtia distans.
,, subconica.
Reticularia microgemma.
Brachythyris integricosta.
,, planata.
Athyris fimbriata.
,, glabristria.
Serpula ? compressa.
,, hexicarinata.
Echinocrinus glabrispina.
,, Urii.
Cyathocrinus pinnatus. ?
Actinocrinus tenuistriatus.
Favosites ? megastoma.
Glauconome bipinnata.
,, pluma.
Fenestella reticularis.

Finner.

Euomphalus calyx.
,, crotalostomus.
Pleurorhynchus giganteus.
,, minax.
Byssoarca clathrata.
Producta concinna.
,, longispina.
,, margaritacea.
,, Martini.
,, setosa.
Leptæna crassistria.
,, Hardensis.
Orthis filiaria.
Spirifera attenuata.
,, gigantea.
Cyrtia laminosa.
Martinia plebeia.

County Donegal, *continued*.

BUNDORAN, *continued*.

Brachythyris concentrica.
Athyris expansa.
Serpula? parallela.
Palæchinus Königii.
Platycrinus expansus.
,, laciniatus.
Cyathocrinus ellipticus.
Favosites? tenuisepta.
Glauconome pluma.
Psammodus porosus.
Cochliodus magnus.

DONEGAL.

Vicinity of.

Pleurotomaria conica.
Producta ovalis.
Spirifera gigantea.
Athyris depressa.

Doorin.

Pleurotomaria canaliculata.
Dolabra equilateralis.
Pecten ellipticus.
,, rugulosus.
Producta caperata.
Orthis granulosa.
Spirifera speciosa.
Cyrtia cuspidata.
Reticularia lineata.
Athyris depressa.

Inver.

Athyris planosulcata.
Atrypa pugnus.

Laghy.

Athyris glabristria.

Lough Esk.

Athyris glabristria.
Echinocrinus Urii.

Stridagh Point.

Leptagonia analoga.
Orthis radialis.
Cyrtia laminosa.

Tinnycahill.

Naticopsis spirata.
Sanguinolites angustatus.
Cyrtia distans.
Syringopora geniculata.

DUNKINEELY.

Aighan Bridge.

Plants.

Ballybodonnell.

Cucullæa tenuistria.
Leptæna multidentata.
Martinia elliptica.
Turbinolia fungites.

Bruckless Chapel.

Plants.

Bruckless.

Clymenia sagittalis.
Discites tetragonus.
Macrocheilus curvilineus.
,, ovalis.
Loxonema tumida.
Euomphalus acutus.
,, calyx.
,, pentangulatus.
,, serpens.
,, tabulatus.
Pleurotomaria canaliculata.
Elenchus antiquus.
Acroculia sigmoidalis.
Patella mucronata.
Sanguinolites angustatus.
,, discors.
,, plicatus.
Pullastra elliptica.
Astarte gibbosa.
Cyprina Egertoni.
Pleurorhynchus minax.
Cypricardia alata.
Axinus deltoideus.
Nucula clavata.
,, gibbosa.
,, Phillipsii.

COUNTY DONEGAL, *continued.*

DUNKINEELY, *continued.*

Crenella acutirostris.
Modiola lingualis.
Pteronites angustatus.
Avicula laminosa.
Lima planicostata.
Pecten ellipticus.
,, interstitialis.
,, macrotis.
,, polytrichus.
,, semicircularis.
,, Sowerbii.
,, spinulosus.
Producta caperata.
,, concinna.
,, elegans.
,, lobata.
,, margaritacea.
,, scabricula.
,, setosa.
,, spinosa.
,, sulcata.
Leptæna Hardrensis.
,, lata. ?
,, sordida.
Orthis filiaria.
,, granulosa.
,, resupinata.
,, semicircularis.
,, sulcata.
Spirifera attenuata.
,, disjuncta.
,, ostiolata.
,, speciosa.
Brachythyris duplicicosta.
,, planicostata.
Athyris concentrica.
,, decussata.
Atrypa fallax.
,, hastata.
,, juvenis.
,, laticosta.
,, pleurodon.
,, radialis.
,, sulcirostris.
Cyathocrinus variabilis.
Actinocrinus tenuistriatus.
Turbinolopsis bina. ?
Turbinolia fungites.
Syringopora laxa.
Manon cibrosum. ?
Fenestella antiqua.
,, flabellata.
,, multiporata.
,, tenuifila.
,, undulata.
Plants.

Killaghtee.

Bellerophon hiulcus.
Inoceramus vetustus.
Brachythyris duplicicosta.

MacSwyne's Bay.

Stigmaria fucoides (roots and portion of trunk).
Sigillaria.
Ferns.

Rahan's Bay.

Euomphalus pentangulatus.
Dolabra securiformis.
Avicula angusta.
Pecten fallax.
Orbicula quadrata.
Producta corrugata.
,, sulcata.
Orthis crenistria.
,, latissima.
,, papilionacea.
Spirifera octoplicata.
,, speciosa.
Cyrtia distans.
Palæchinus gigas.
,, Konigii.
Echinocrinus Urii.
Cyathocrinus macrocheirus.
Actinocrinus tenuistriatus.
Syringopora ramulosa.

St. John's Point.

Discites sulcatus.
Loxonema constricta.

County Donegal, *continued.*

DUNKINEELY, *continued.*

Loxonema sulculosa.
Euomphalus acutus.
Pleurotomaria canaliculata.
Pleurorhynchus giganteus.
Producta latissima.
,, pectinoides.
,, pugilis.
Leptæna multidentata.
Orthis arcuata.
,, crenistria.
,, latissima.
,, papilionacea.
,, parallela.
Orthis resupinata.
Cyrtia cuspidata.
,, simplex.
Athyris decussata.
,, hispida.
Echinocrinus Urii.
Platycrinus punctata.
Lithodendron sexdecimale.
Syringopora catenata.
,, geniculata.
,, ramulosa.
Jania antiqua.
,, crassa.
Favosites Gothlandica.

County Down.

COMBER.

Castle Espie.

Actinoceras giganteum.
,, pyramidatum.
Naticopsis elongata.
Producta gigantea.
,, laxispina.
,, Scotica.
Orthis cylindrica.

HOLLYWOOD.

Cultra.

Kellia gregaria.
Modiola Macadami.
Cythere bituberculata.
,, cornuta.
,, costata.
,, elongata.
,, inornata.
,, trituberculata.
Spirorbis intermedius.
,, omphalodes.
Fern stem.
Sternbergia approximata.
Plants.
Palæoniscus, sp.
Holoptychius Portlockii.
Ctenacanthus.

County Dublin.

BALBRIGGAN.

Courtlough (Man-of-War).

Posidonia Becheri.
,, similis.
Leptæna papyracea.

Flemingstown.

Pecten mundus.

Salmon (Man-of-War).

Avicula lunulata.
Producta corrugata.
,, laxispina.
,, pectinoides.
Leptagonia plicatilis.
Spirifera trigonalis.
Atrypa acuminata.

County Dublin, *continued.*

CLONTARF.

Vicinity of.

Plants.

HOWTH.

Vicinity of.

Goniatites Listeri.
Euomphalus acutus.
Venerupis cingulatus.
Avicula laminosa.
,, lunulata.
Pecten arenosus.
,, concentrico-striatus.
,, ellipticus.
,, gibbosus.
,, granosus.
,, Sowerbii.
Producta aculeata.
,, antiquata.
,, fragaria.
,, lirata.
,, margaritacea.
,, rugata.
,, spinosa.
Orthis filiaria.
Spirifera speciosa.
,, Urii.
Martinia obtusa.
Athyris decussata.
Atrypa lachryma.
,, sacculus.
,, sulcirostris.
,, ventilabrum.
Seminula pisum.
,, rhomboidea.
Phillipsia gemmulifera.
,, truncatula.
Platycrinus rugosus.
Favosites megastoma.
Vincularia dichotoma.
Fenestella membranacea.
,, reticularis.
,, tenuifila.
,, undulata.
Retepora undata.

Poulscadden.

Loxonema tumida.
Sanguinolites angustatus.
Pullastra bistriata.
Pleurorhynchus aliformis.
,, armatus.
,, minax.
Pecten megalotis.
Producta concinna.
,, fragaria.
,, granulosa.
,, longispina.
,, pustulosa.
,, rugata.
,, scabricula.
,, setosa.
Leptæna volva.
Orthis crenistria.
,, filiaria.
,, granulosa.
,, interlineata.
,, longisulcata.
,, parallela.
,, resupinata.
,, semicircularis.
Spirifera attenuata.
,, disjuncta.
,, rudis.
Cyrtia distans.
,, laminosa.
Reticularia microgemma.
Athyris concentrica.
,, decussata.
,, fimbriata.
Atrypa fallax.
,, hastata.
Phillipsia gemmulifera.
Platycrinus interscapularis.
Cyathocrinus ellipticus.
Rhodocrinus verus.
Turbinolia fungites.
Siphonophyllia cylindrica.
Lithodendron sexdecimale.
Syringopora bifurcata.
Favosites megastoma.
,, spongites.

County Dublin, *continued*.

HOWTH, *continued*.

Favosites tenuisepta.
Verticillopora abnormis.
Millepora oculata.
,, rhombifera.
,, spicularis.
Glauconome bipinnata.
,, pluma.
Ptylopora macropora.
,, pluma.
Fenestella nodulosa.
,, spongites.
,, tenuifila.
,, undulata.
Anomia antiqua.
Cochliodus.

MALAHIDE.

Vicinity of.

Orthoceras cylindraceum.
Euomphalus æqualis.
,, rotundatus.
,, tabulatus.
Acroculia triloba.
Pleurorhynchus aliformis.
,, fusiformis.
Pecten fallax.
Producta caperata.
,, concinna.
,, longispina.
,, pugilis.
,, punctata.
,, quincuncialis.
,, scabricula.
,, setosa.
,, spinosa.
,, sulcata.
Leptagonia analoga.
Orthis crenistria.
,, filiaria.
Spirifera attenuata.
,, calcarata.
,, crispa.
,, disjuncta.
,, ostiolata.
,, rotundata.
,, speciosa.
Cyrtia cuspidata.
,, distans.
,, laminosa.
,, semicircularis.
,, simplex.
Martinia elliptica.
Reticularia microgemma.
Brachythyris duplicicosta.
,, pinguis.
Athyris concentrica.
,, decussata.
,, depressa.
,, glabristria.
Atrypa flexistria.
,, lachryma.
,, pleurodon.
,, proava.
,, radialis.
,, sacculus.
,, ventilabrum.
Echinocrinus Urii.
Platycrinus gigas.
Cyathocrinus inequidactylus.
,, ornatus.
,, variabilis.
Actinocrinus Gilbertsoni.
,, pusillus.
,, triacontadactylus.
Amplexus Sowerbii.
Turbinolia fungites.
Syringopora geniculata.
,, ramulosa.
Favosites megastoma.
,, serialis.
,, spongites.
,, tumida.
Stromatopora concentrica.
Syringopora geniculata.
Psammodus porosus.
Verticillopora abnormis.
Millepora interporosa.
Ptylopora pluma.
Fenestella antiqua.
,, carinata.
,, formosa.
,, tenuifila.
,, undulata.

COUNTY DUBLIN, *continued.*

OLDTOWN.

Vicinity of.

Turritella tenuistria.

RUSH.

Curkeen.

Orthoceras cylindraceum.
Bellerophon tenuifascia.
Loxonema polygyra.
Euomphalus æqualis.
Platyschisma helicoides.
Reticularia lineata.
Stromatopora subtilis.

Loughshinny.

Posidonia Becheri.
,, membranacea.
,, lateralis.
Plants.

Vicinity of.

Producta granulosa.
,, hemisphærica.
Leptagonia plicatilis.
Leptæna convoluta.
Reticularia lineata.
Brachythyris pinguis.
Atrypa juvenis.
Griffithides obsoletus.
Orthoceras cinctum.
Posidonia Becheri.
,, costata.
,, lateralis.
,, membranacea.
,, tuberculata.
Pecten plicatus.
Producta aculeata.
,, concinna.
,, membranacea.
,, rugata.
Atrypa semisulcata.
Millepora oculata.

SKERRIES.

Baldongan.

Posidonia membranacea.

Ballykea.

Euomphalus acutus.
,, æqualis.
,, pentangulatus.
Pleurorhynchus minax.
Producta Edelburgensis.
,, sulcata.

Drumlattery.

Macrocheilus rectilineus.

Lane.

Naticopsis Phillipsii.

Milverton.

Pleurotomaria concentrica.
Producta corrugata.
,, pustulosa.
Martinia oblata.
Brachythyris planicostata.
Athyris expansa.
,, obtusa.

St. Doolagh's.

Meleagrina tesselata.
Pecten granosus.
Producta scabricula.
Leptæna volva.
Martinia phalæna.
Brachythyris planata.
Atrypa flexistria.
,, pugnus.
Serpulites membranaceus.
Cyathocrinus megastylus.
,, pinnatus.
Millepora similis.
Retepora prisca.
Producta flexistria.
Brachythyris pinguis.

SWORDS.

Rathbale.

Athyris concentrica.

County Fermanagh.

BOA ISLAND.

Ardshankill.

Axinus centralis.
Dolabra orbicularis.
Modiola megaloba.
Pteronites ventricosus.

CHURCHILL.

Vicinity of.

Spirifera minima.
Athyris globularis.

EDERNY.

Drum.

Euomphalus crotalostomus.

Drumkeeran.

Producta Scotica.

Vicinity of.

Orthis papilionacea.

ENNISKILLEN.

Belmore Mountain.

Cyathocrinus planus.
Producta concinna.
Turbinolia fungites.
Favosites tumida.
Glauconome pluma.
Fenestella laxa.

Carrickreagh.

Euomphalus crotalostomus.

Carrowtremal.

Meleagrina radiata.
Pecten interstitialis.
Orthis resupinata.

Cornacarrow.

Producta antiquata.
,, elegans.
,, quincuncialis.
,, scabricula.
Leptagonia analoga.
Orthis gibbera.
,, resupinata.
Spirifera attenuata.
,, rotundata.
Martinia glabra.
,, oblata.
Amplexus Sowerbii.
Aulopora gigas.

Derryvullan.

Platycrinus rugosus.
Actinocrinus amphora.

Knockninny.

Meleagrina tessellata.
Pecten arenosus.
,, interstitialis.
Producta punctata.
,, sulcata.
Spirifera minima.
Atrypa flexistria.
,, sulcirostris.
Pentremites Derbiensis.
Hemitrypa Hibernica.

Lough Erne.

Turbinolia fungites.

Ring.

Discites sulcatus.
Euomphalus pentangulatus.
Pleurotomaria concentrica.
Sanguinolites arcuatus.
Leptagonia analoga.
Spirifera attenuata.
Reticularia imbricata.
Naticopsis canaliculata.

County Fermanagh, *continued.*

KESH.

Carrickoughter.

Loxonema sulcatula.
Inoceramus pernoides.

Vicinity of.

Producta latissima.

Drumcurren.

Avicula Verneuillii.

River Banagh, Drumcurren.

Sedgwickia attenuata.
Pæcilodus, sp.
Sphenopteris linearis.

Drumgowna.

Pleurotomaria altavittata.

Tullanaguiggy.

Producta tortilis.

TEMPO.

Leam, Moneyburn River.

Murchisonia Larcomi.
Cypricardia socialis.
Lingula squamiformis.

County Galway.

GORT.

Creggamore.

Producta prælonga.
,, setosa.
Orthis arcuata.
,, crenistria.
Spirifera crispa.
,, inornata.
Atrypa fallax.
Atrypa juvenis.
,, pleurodon.
,, radialis.
Platycrinus contractus.
Millepora oculata.
,, similis.

PORTUMNA.

Vicinity of.

Goniatites Listeri.

County Kerry.

KILLARNEY.

Brickeen Bridge.

Pecten arachnoideus.
Plants.

CASTLE ISLAND.

Vicinity of.

Pleurorhynchus Hibernicus.

Currens.

Producta caperata.
Leptagonia analoga.
Leptagonia nodulosa.
Orthis comata.
,, crenistria.
,, interlineata.
,, tenuistriata.
Spirifera megaloba.
Cyrtia cuspidata.
,, distans.
Athyris decussata.
Atrypa fallax.
Phillipsia truncatula.
Cyathocrinus geometricus.
,, variabilis.
Turbinolopsis bina.

County Kerry, *continued*.

CASTLE ISLAND, *continued*.

Vicinity of.

Turbinolopsis pauciradialis.
,, pluriradialis.
Fenestella antiqua.
,, formosa.
,, reticularis.

TRALEE.

Castleogary.

Spirifera inornata.

Ballymacelligott.

Siphonaria Konincki.

New Canal.

Patella scutiformis.

County Kildare.

CLANE.

Millicent.

Orthoceras pyramidale.
Loxoceras Breynii.
,, laterale.
Poterioceras fusiforme.
,, ventricosum.
Actinoceras giganteum.
Goniatites fasciculatus.
,, latus.
,, Listeri.
,, obtusus.
Discites costellatus.
,, discors.
,, latidorsatus.
,, subsulcatus.
Temnocheilus biangulatus.
,, cariniferus.
,, costalis.
,, multicarinatus.
,, sulciferus.
Nautilus dorsalis.
Bellerophon lævis.
,, obsoletus.
,, tenuifascia.
Macrocheilus acutus.
,, curvilineus.
,, imbricatus.
Loxonema constricta.
,, sulculosa.
Turritella megaspira.
Naticopsis elongata.
,, Phillipsii.
Euomphalus acutus.
Euomphalus calyx.
,, neglectus.
,, pentangulatus.
Platyschisma helicoides.
Pleurotomaria decussata.
,, filosa.
,, Griffithii.
,, multicarinata.
Trochella prisca.
Acroculia carinata.
,, vetusta.
Patella sinuosa.
Umbrella lævigata.
Sanguinolites arcuatus.
,, tumidus.
Lutraria prisca.
Cyprina Egertoni.
Cardiomorpha axiniformis.
,, corrugata.
,, oblonga.
Pleurorhynchus Hibernicus.
,, minax.
Leptodomus senilis.
Venerupis obsoletus.
,, scalaris.
Amphidesma subtruncatum.
Byssoarca obtusa.
,, reticulata.
Lithodomus dactyloides.
Mytilus Flemingi.
Inoceramus orbicularis.
,, pernoides.
Pteronites latus.
Avicula lævigata.
,, laminosa.

County Kildare, *continued.*

CLANE, *continued.*

Avicula lunulata.
,, recta.
Lima lævigata.
Pecten arenosus.
,, concentrico-striatus.
,, dissimilis.
,, ellipticus.
,, elongatus.
,, fallax.
,, filatus.
,, Forbesii.
,, granosus.
,, hians.
,, Sowerbii.
Crania vesiculosa.
Producta antiquata.
,, flexistria.
,, granulosa.
,, intermedia.
,, laciniata.
,, margaritacea.
,, mesoloba.
,, pectinoides.
,, producta.
,, rugata.
,, setosa.
Leptæna ?
,, serrata.
,, volva.
Orthis crenistria.
,, divaricata.
,, papilionacea.
,, resupinata.
,, tuberculata.
Spirifera attenuata.
,, bisulcata.
,, decemcostata.
,, ornithorhyncha.
,, princeps.
,, rotundata.
Cyrtia cuspidata.
,, distans.
,, linguifera.
Martinia elliptica.
,, glabra.
Martinia plebeia.
Brachythyris pinguis.
Athyris glabristria.
Actinoconchus paradoxus.
Atrypa bifera.
,, cordiformis.
,, ferita.
,, hastata.
,, pugnus.
,, reniformis.
,, sacculus.
Seminula pentahedra.
Griffithides globiceps.
Phillipsia discors.
,, gemmulifera.
,, quadriserialis.
Eutomoconchus Scouleri.
Palæchinus ellipticus.
Peteriocrinus impressus.
Rhodocrinus abnormis.
Actinocrinus polydactylus.
,, triacontadactylus.
Amplexus Sowerbii.
Vincularia dichotoma.
Fenestella crassa.
,, membranacea.
Retepora undata.
Cochliodus gracilis.

MAYNOOTH.

Paget Priory.

Goniatites Gibsoni.

RATHANGAN.

Boston.

Producta concinna.

RATHCOOLE.

Ardclough.

Orthoceras ovale.
Loxoceras laterale.
Temnocheilus cariniferus.
,, multicarinatus.
,, sulciferus.

County Kildare, *continued.*

RATHCOOLE, *continued.*

Bellerophon apertus.
,, hiulcus.
Naticopsis Phillipsii.
Euomphalus pentangulatus.
Pleurotomaria Griffithii.
Producta antiquata.
Producta fragaria.
,, pectinoides.
Orthis papilionacea.
Spirifera rhomboidea.
,, rotundata.
Atrypa pugnus.
Platycrinus rugosus.
Actinocrinus triacontadactylus.

County Leitrim.

CLOONE.

Drumconny.

Lepidodendron new.

ENNISKILLEN.

Black Lion.

Orthoceras attenuatum.
,, cylindraceum.
Campyloceras arcuatum.
Goniatites excavatus.
,, striolatus.
Discites sulcatus.
Nautilus cyclostomus.
Turritella suturalis.
Naticopsis spirata.
Murchisonia quadricarinata.
Lutraria prisca.
Cypricardia cuneata.
Arca cancellata.
Cucullæa arguta.
Byssoarca costellata.
,, reticulata.
Inoceramus vetustus.
Meleagrina quadrata.
,, radiata.
Pteronites semisulcatus.
Lima lævigata.
Pecten asperulus.
,, gibbosus.
,, interstitialis.
,, Jonesii.
,, megalotis.
Producta concinna.
Producta corrugata.
,, granulosa.
,, laxispina.
,, mesoloba.
,, pectinoides.
,, pustulosa.
,, rugata.
,, setosa.
,, spinosa.
,, sulcata.
Leptagonia analoga.
Orthis crenistria.
Spirifera attenuata.
,, bisulcata.
,, minima.
,, rhomboidea.
Cyrtia linguifera.
Martinia plebeia.
Reticularia imbricata.
Athyris fimbriata.
Actinoconchus paradoxus.
Atrypa hastata.
,, pleurodon.
,, pugnus.
,, sacculus.
,, ventilabrum.
Seminula rhomboidea.
Entomoconchus Scouleri.
Pentremites florealis.
Amplexus tortuosus.
Favosites spongites.
Vincularia dichotoma.
Glauconome bipinnata.
,, pluma.
,, pulcherrima.

County Leitrim, *continued*.

ENNISKILLEN, *continued*.

Fenestella crassa.
,, ejuncida.
,, laxa.
,, nodulosa.
,, polyporata.
,, quadradecimalis.
,, tenuifila.
,, undulata.
,, varicosa.
Hemitrypa Hibernica.
Polypora marginata.
,, papillata.
,, verucosa.

DRUMOD (MOHILL).

Bleankillew.

Plants.

MANORHAMILTON.

Vicinity of.

Acroculia vetusta.
Avicula gibbosa.
Producta aculeata.
,, elegans.
,, laxispina.
Leptagonia plicatilis.
Spirifera gigantea.
,, speciosa.
Echinocrinus Urii.
Pentremites Derbiensis.
,, ellipticus.
Actinocrinus constrictus.
,, costus.
,, triacontadactylus.
Tragos semicirculare.
Dirinus Bucklandi.
Sanguinolites curtus.
,, Iridinoides.
Byssoarca semicostata.
Pteronites sulcatus.
Lima semisulcata.
Pecten megalotis.
,, segregatus.
Producta antiquata.
,, granulosa.
,, pugilis.
Orthis arcuata.
Spirifera Urii.
Athyris decussata.
Atrypa ventilabrum.
Serpulites carbonarius.
Siphonophyllia cylindrica.
Lithodendron affine.
Flustra palmata.

MOHILL.

Drumod.

Pleurorhynchus nodulosus.

Fearnaght Lough River.

Malleus orbicularis.

Tullyoran.

Naticopsis neritoides.
Producta concinna.
,, latissima.
,, quincuncialis.
Spirifera gigantea.
Martinia obtusa.

Mohill, Vicinity of.

Avicula cycloptera.
Pecten plicatus.
,, quinquelineatus.
,, scalaris.
,, Sowerbii.
Producta corrugata.
,, margaritacea.
,, pugilis.
,, quincuncialis.
,, scabricula.
,, setosa.
,, sulcata.
Leptæna Hardrensis.
Orthis parallela.

County Leitrim, *continued.*

MOHILL, *continued.*

Spirifera gigantea.
,, ostiolata.
Cyrtia semicircularis.
Reticularia imbricata.
,, microgemma.
Brachythyris integricosta.
Athyris glabristria.
,, squamosa.
Atrypa laticosta.
Cyathocrinus megastylus.
Favosites tenuisepta.
Millepora interporosa.
Vincularia parallela.
Retepora undata.

County Limerick.

KILMALLOCK.

Chicken Hill.

Loxonema impendens.
Euomphalus anguis.

Vicinity of.

Loxoceras distans.
Goniatites sphæroidalis.
Temnocheilus pinguis.
Acroculia triloba.
Sanguinolites contortus.
Mactra incrassata.
Cyprina Egertoni.
Ichthyorachis Newenhami.
Fenestella flabellata.

County Londonderry.

DRAPERSTOWN.

Cullion.

Loxonema polygyra.
Venus centralis.
Cypricardia concinna.
,, minima.
Sedgwickia bullata.
,, globosa.
Pecten simplex.
Monotis æqualis.
Cythere oblonga.
,, pusilla.

Dromard.

Macrocheilus fimbriatus.
Murchisonia elongata.
Axinus nuculoides.
Nucula stilla.
Cythere arcuata.
,, impressa.
Plants.
Fern stem, new.

Mormeal.

Palæoniscus, sp.

Moyheeland.

Palæoniscus, sp.
Amblypterus, sp.
Gyracanthus, sp.?
,, new.
,, tuberculatus.
Holoptychius Portlocki.
Phyllolepis?
Plants.

MAGHERA.

Ballynure.

Amblypterus, sp.
Holoptychius Portlockii.

Fallagloon.

Fern stems.
Holoptychius Portlockii.

MAGHERAFELT.

Slievegallion.

Spirifera bisulcata.
Turbinolia fungites.

County Longford.

BALLYMAHON.

Mullawornia.

Goniatites striolatus.
Pecten plicatus.
Producta aculeata.
,, fimbriata.
Reticularia imbricata.
Actinoconchus paradoxus.
Amplexus tortuosus.

Shrule.

Cycloceras lævigatum.

Tirlecken.

Loxoceras laterale.
Temnocheilus biangulatus.
,, cariniferus.
,, crenatus.
,, multicarinatus.
Bellerophon tangentialis.
Loxonema tumida.
Turritella tenuistria.
Euomphalus pentangulatus.
,, tabulatus.
Brachythyris pinguis.

DRUMLISH.

Monaduff.

Orthoceras attenuatum.
Nucula oblonga.
Ctenacanthus.
Oracanthus Milleri.
Holoptychius Portlocki.
Plants.

GRANARD,

Vicinity of.

Temnocheilus biangulatus.
Euomphalus catillus.
,, tabulatus.
Producta quincuncialis.
Orthis papilionacea.
Spirifera bisulcata.
,, calcarata.
Cyrtia linguifera.
Atrypa sacculus.
Bairdia curtus.
Gorgonia Zic-Zac.

LANESBOROUGH.

Rathcline.

Orthoceras cylindraceum.
Producta quincuncialis.
,, setosa.
Leptagonia plicatilis.
Spirifera bisulcata.
Cyrtia linguifera.
Martinia oblata.
,, obtusa.
Brachythyris exarata.
,, pinguis.
Athyris glabristria.
,, pugnus.
Lithodendron irregulare.
Lithostrotion striatum.

LONGFORD.

Carrickboy.

Pleurorhynchus inflatus.

Kilcommock.

Nautilus dorsalis.
Naticopsis Phillipsii.
Fenestella membranacea.

Vicinity of.

Temnocheilus multicarinatus.
Orthis crenistria.

SHRULE.

Tirlecken.

Temnocheilus crenatus.
Euomphalus tabulatus.

County Louth.

CARLINGFORD.

Vicinity of.

Bellerophon apertus.
,, costatus.
,, tangentialis.
Siphonophyllia cylindrica.

DUNDALK.

Knockagh.

Actinoconchus paradoxus.

County Mayo.

BALLYCASTLE.

Ballinglen.

Euomphalus elongatus.
Modiola subparallela.
Lima concinna.
Atrypa angularis.
Helodus mammillaris.

Bunatrahir Bay.

Sanguinolites plicatus.
Ferns.

Carrowcor.

Stigmaria ficoides.
Sigillaria.
Lepidodendron.
Producta hemisphærica.
Atrypa Gregaria.

Doonadoba.

Orthoceras laterale.
Bellerophon apertus.
Murchisonia elongata.
Loxonema constricta.
Euomphalus acutus.
,, pentangulatus.
Producta hemisphærica.
Orthis crenistria.
Spirifera attenuata.
Palæchinus elegans.
Turbinolia fungites.
Favosites megastoma.
Fenestella antiqua.
Psammodus porosus.
Cladodus mirabilis.

Kilbride.

Orthoceras attenuatum.
Temnocheilus tuberculatus.
Sanguinolites sulcatus.
Pinna mutica.
Pecten interstitialis.
Producta aculeata.
,, fimbriata.
Orthis parallela.
Spirifera calcarata.
Athyris globularis.
Atrypa gregaria.
Griffithides obsoletus.
Phillipsia Colei.
Turbinolia fungites.
Fenestella undulata.

BANGOR.

Larganmore.

Cypricardia tumida.
Axinus axiniformis.
,, carbonarius.
Nucula leiorhynchus.
Pecten duplicicosta.
Atrypa indentata.
,, virgo.
Cythere Hibbertii.
,, subrecta.
Astræa pentagona.

KILLALA.

Crosspatrick.

Goniatites intercostalis.
Discites sulcatus.
Pullastra crassistria.

County Mayo, *continued*.

KILLALA, *continued*.

Vicinity of.

Turbo spirata.
Sanguinolites tricostatus.
Mactra ovata.

Kilcummin, Killala Bay.

Macrocheilus canaliculatus.
Atrypa compta.
Lacuna antiqua.
Ferns and Fucoides.

Killogunra.

Avicula informis.
Pecten concavus.

Killybrone.

Stromatopora concentrica.
Fenestella plebeia.

Mullaghfarry.

Discites sulcatus.

Townplots.

Anatina attenuata.
,, deltoidea.
Cypricardia modiolaris.
Pecten conoideus.
,, depilis.
,, pera.

LACKAN BAY.

Kilcummin.

Sanguinolites transversus.
Axinus carbonarius.
Helodus planus.

County Meath.

DRUMCONDRA.

Ardagh.

Bellerophon apertus.
,, tangentialis.
,, tenuifascia.
Euomphalus acutus.
,, pileopsideus.
,, rotundatus.
Leptodomus senilis.
Inoceramus vetustus.
Avicula laminosa.
Lima alternata.
,, prisca.
Pecten ovatus.
,, semistriatus.
Producta Edelburgensis.
,, fimbriata.
,, laxispina.
,, Martini.
,, mesoloba.
,, pustulosa.
,, striata.
,, sublævis.
,, sulcata.
Leptagonia plicatilis.
Orthis crenistria.
,, radialis.
Spirifera rhomboidea.
,, trigonalis.
Martinia elliptica.
,, oblata.
,, plebeia.
Reticularia imbricata.
,, reticulata.
Brachythyris duplicicosta.
,, integricosta.
Athyris expansa.
,, globularis.
,, squamosa.
,, excavata.
,, pugnus.
,, sacculus.
,, ventilabrum.
Echinocrinus vetustus.
Turbinolia fungites.

Ballyhoe Lake.

Producta hemisphærica.

County Meath, *continued*.

DULEEK.

Mullaghfin.

Euomphalus rotundatus.
Producta Martini.
Spirifera striata.
,, trigonalis.
Martinia decora.
,, oblata.
,, plebeia.
,, symmetrica.
Brachythyris duplicicosta.
,, planicostata.
Atrypa bifera.
,, pugnus.
Orthis papilionacea.
Spirifera attenuata.
,, crispa.
,, octoplicata.
,, trigonalis.
Martinia oblata.
Atrypa pleurodon.
,, sulcirostris.
Actinocrinus triacontadactylus.
Lithodendron affine.
Favosites spongites.

Cruisetown.

Posidonia Becheri.

Rathgillen.

Orthoceras attenuatum.
,, cinctum.
,, ovale.
Cucullæa tenuistria.
Producta Martini.
,, pectinoides.
,, sulcata.
Leptagonia analoga.
Spirifera rhomboidea.
Athyris planosulcata.

MOYNALTY.

Horath.

Bellerophon apertus.
Turritella tenuistria.
Naticopsis spirata.
Euomphalus catillus.
Cyprina Egertoni.
Pleurorhynchus aliformis.
Spirifera ostiolata.
Turritella suturalis.

NAVAN.

Walterstown.

Posidonia membranacea.

NOBBER.

Balsitric.

Euomphalus marginatus.
Pleurorhynchus giganteus.
Cypricardia cuneata.

Cregg.

Loxoceras laterale.
Goniatites mutabilis.
,, obtusus.
Euphemus Urii.
Cucullæa tenuistria.
Pecten Murchisoni.
Producta Edelburgensis.
,, maxima.
,, pectinoides.
,, sulcata.

SKREEN.

Walterstown.

Atrypa semisulcata.

SLANE.

Vicinity of.

Cyrtia semicircularis.

TRIM.

Laracor.

Temnocheilus biangulatus.
Macrocheilus acutus.
Turritella tenuistria.
Producta mesoloba.
Seminula pisum.
Cythere inflata.
Gorgonia Lonsdaleiana.
Glauconome pluma.

County Monaghan.

CARRICKMACROSS.

Clonturk.

Pleurorhynchus trigonalis.
Spirifera ostiolata.

Mullylusty.

Pleurorhynchus giganteus.

EMYVALE.

Killyrean, Upper.

Goniatites intercostalis.

Tonyshanderry.

Pecten flexuosus.

MONAGHAN.

Dundonagh.

Producta hemisphærica.
,, Scotica.

Vicinity of.

Spirifera ostiolata.
Producta Scotica.
Orthis Kellii.

Leek.

Cardium orbiculare.

Mullaghliss.

Producta Scotica.

Queen's County.

MARYBOROUGH.

Cloghran.

Spirifera attenuata.

County Roscommon.

BALLINASLOE.

Moore.

Cardiomorpha oblonga.
Producta muricata.
Spirifera attenuata.
Athyris squamosa.
Amplexus Sowerbii.

BOYLE.

Vicinity of.

Producta concinna.
,, spinosa.
Spirifera rotundata.
Athyris fimbriata.
Favosites parasitica.

Cleen.

Turbinolia fungites.
Favosites tenuisepta.

Drumdoe.

Producta scabricula.
Athyris expansa.
,, sulcirostris.

Grangemore.

Producta spinosa.
Orthis filiaria.
Favosites spongites.

Lisardrea.

Producta Martini.
Leptæna Hardrensis.
Orthis filiaria.

Termon.

Reticularia striatella.
Leptæna hardrensis.
Orthis papilionacea.
Turbinolia fungites.
Favosites megastoma.

County Roscommon, *continued.*

CARRICK-ON-SHANNON.

Killukin.

Producta elegans.
,, granulosa.
Leptagonia analoga.
Favosites spongites.

CASTLEREAGH.

Kiltullagh.

Bellerophon apertus.
Naticopsis elongata.
Producta corrugata.
,, gigantea.
,, scabricula.
Orthis papilionacea.
Atrypa acuminata.
Lithodendron affine.

KEADUE.

Cartronaglogh.

Producta latissima.
,, sulcata.

Brachythyris pinguis.
Griffithides obsoletus.

ROSCOMMON.

Rathmoyle House.

Loxonema constricta.
Euomphalus crotalostomus.
Cyrtia linguifera.
Reticularia imbricata.
Atrypa hastata.

Vicinity of.

Lithodendron sociale.

Strokestown.

Euomphalus cristatus.

TULSK.

Toberory.

Loxonema brevis.
Acroculia canaliculata.

County Sligo.

EASKY.

Ballymeeny.

Astarte quadrata.

Bunowna.

Pinna flexicostata.
Cythere orbicularis.
Astræa irregularis.

Carrowmably.

Taxocrinus polydactylus.

SLIGO.

Carnly.

Atrypa sulcirostris.

TEMPLEBOY OR TOBERCURRY.

Carrowmacrory.

Pandora clavata.
Sedgwickia gigantea.
Mytilus comptus.

TOBERCURRY.

Magheramore.

Astræa aranea.
Lithodendron pauciradialis.

County Tipperary.

CLOGHEEN.

Newcastle.

Producta Martini.
Cyrtia cuspidata.

KNOCKLOFTY.

Vicinity of.

Cyathocrinus variabilis.
Turbinolopsis Celtica.

NENAGH.

Vicinity of.

Goniatites sphæroidalis.

PORTUMNA.

Carrigahorig.

Loxoceras laterale.
Turritella suturalis.
Euomphalus pentangulatus.

County Tyrone.

AUGHER.

Fymore Todd.

Turritella tenuistria.
Atrypa radialis.

AUGHNACLOY.

Lismore.

Favosites megastoma?

BALLYGAWLEY.

Aunaghilla.

Orthis Kellii.

Fasglassagh.

Teredo? antiqua.

Knockonny.

Pecten Knockonniensis.

CASTLEDERG.

Edenasop.

Orthis crenistria.

Soraghy.

Producta Scotica.
Orthis papilionacea.
Siphonophyllia cylindrica.
Lithodendron cæspitosum.
Favosites megastoma?

CLOGHER.

Aghnaglogh.

Modiola Macadami.
Dithyrocaris Colei.
„ Scouleri.
Cythere excavata.
Spirorbis globosus.
„ minutus.

Ballymacan.

Spirorbis globosus.

Mullaghtinny.

Goniatites reticulatis.
Euomphalus quadratus.
Sanguinolites undatus.
Axinus axiniformis.
„ obliquus.
„ obovatus.
Dolabra gregaria.
Nucula longirostris.

COOKSTOWN.

Clare.

Pleurotomaria concentrica.
Acroculia angustata
Athyris glabristria.

Donaghrisk.

Platyschisma Jamesii.
Producta aurita.

COUNTY TYRONE, *continued.*

Kildress.

Atrypa triplex.
Phillipsia mucronata.
Sabella antiqua.

Cookstown.

Discites trochlea.
Bellerophon costatus.
Euphemus Urii.
Turritella suturalis.
Naticopsis plicistria.
Euomphalus rotundatus.
Platyschisma helicoides.
Pleurotomaria carinata.
Patella mucronata.
Dentalium inornatum.
Sanguinolites sulcatus.
Donax primigenius.
Nucula rectangularis.
Pinna flabelliformis.
Pecten cœlatus.
Producta aurita.
,, concinna.
,, elegans.
,, fimbriata.
,, Martini.
,, Scotica.
,, setosa.
Cyrtia cuspidata.
,, senilis.
Martinia plebeia.
Atrypa isorhyncha.
,, laticliva.
,, radialis.
,, virgo.
Phillipsia Kellii.
Astræa crenularis.
Lithodendron cæspitosum.
Lithostrotion striatum.
Verticillopora dubia.
Cochliodus.

DRUMQUIN.

Ardsallagh.

Syphonophyllia cylindrica.

Vicinity of.

Turritella acicula.
Sanguinolites Iridinoides.
Pullastra elliptica.
Nucula attenuata.
,, brevirostris.
Orthis papilionacea.

Drumscraw.

Loxoceras laterale.
Goniatites striatus.
Discites oxystomus.
Bellerophon apertus.
Producta concinna.
Athyris triloba.
Syringopora geniculata.

Lackagh.

Bellerophon apertus.
Loxonema pulcherrima.
Euomphalus tabulatus.
Patella scutiformis.
Sanguinolites angustatus.
,, plicatus.
Cypricardia rhombea.
Nucula gibbosa.
Producta hemisphærica.
,, lobata.
,, Martini.
,, punctata.
Athyris planosulcata.
Siphonophyllia cylindrica.
Lithodendron affine.
Favosites tenuisepta.
Jania crassa.
Glauconome pluma.

Magherenny.

Bellerophon cornu-arietis.

Meenacarighy.

Favosites megastoma.

County Tyrone, *continued*.

DUNGANNON.

Drumreagh.

Solenopsis minor.

Killymeal.

Sanguinolites radiatus.
Byssoarca obtusa.
Pteronites semisulcatus.
Lima alternata.
,, decussata.
Pecten æqualis.
,, cancellatulus.
,, concentrico-striatus.
,, ellipticus.
,, granosus.
,, intercostatus.
,, tripartitus.
Producta concinna.
,, gigantea.
,, latissima.
,, Martini.
Brachythyris planicostata.
Phillipsia cælata.
Syringopora laxa.
Favosites tumida.
Vincularia megastoma.
,, parallela.
,, raricosta.
Glauconome gracilis.
,, pluma.
Fenestella formosa.
,, frutex.
,, multiporata.
Polypora marginata.
,, papillata.

Mulnahunch.

Euomphalus tabulatus.

Roughan.

Sanguinolites Iridinoides.
Griffithides calcaratus.

FIVEMILETOWN,

Vicinity of.

Naticopsis plicistria.
Atrypa fallax.

Rahoran.

Avicula Thomsoni.
Pecten bellis.
,, consimilis.
,, irregularis.
Leptæna perlata.
Orthis caduca.
Atrypa nana (with Pecten consimilis).
Orbiculites antiquus.

LISBELLAW.

Killyclogby.

Phragmoceras flexistria.
Sanguinolites costellatus.
Pecten micropterus.
Echinocrinus triserialis.

OMAGH.

Dromore.

Producta Scotica.

STEWARTSTOWN.

Tumpher.

Astræa crenularis.

County Waterford.

ARDMORE.

Ardoe.

Leptæna plicata.
Spirifera aperturata.
Atrypa fallax.
Actinocrinus tenuistriatus.

Curragh.

Orthis arachnoidea.
,, parallela.
Cyrtia cuspidata.
Athyris decussata.
Atrypa striatula.

County Waterford, *continued.*

ARDMORE, *continued.*

Cyathocrinus geometricus.
Favosites fibrosa.

CLONMEL.

Kilnamack.

Leptagonia nodulosa.
Spirifera crispa.
,, disjuncta.
Cyrtia distans.
Atrypa fallax.
Fenestella tenuifila.

DUNGARVAN.

Ballinacourty.

Orthoceras cylindraceum.
,, ovale.
Loxoceras laterale.
Goniatites micronotus.
Temnocheilus biangulatus.
Naticopsis Phillipsii.
Cyrtia distans.
Glauconome antiqua.
,, crassa.
Retepora prisca.
,, undata.
Goniatites Gibsoni.
,, striolatus.
Pleurorhynchus aliformis.
Pecten arachnoideus.
Producta aculeata.
,, caperata.
,, interrupta.
,, membranacea.
,, rugata.
,, sulcata.
Leptagonia rugosa.
Leptæna convoluta.
,, sericea.
Orthis arcuata.
,, granulosa.
,, interlineata.
,, longisulcata.
Spirifera attenuata.
,, bisulcata.
,, octoplicata.
,, rhomboidea.
,, rudis.
Cyrtia laminosa.
Martinia phalæna.
Brachythyris integricosta.
,, ovalis.
,, pinguis.
Athyris concentrica.
,, glabristria.
Atrypa desquamata.
,, hastata.
,, insperata.
,, striatula.
Calymene granulata.
Adelocrinus histrix.
Platycrinus granulatus.
,, interscapularis.
,, similis.
,, tuberculatus.
Taxocrinus macrodactylus.
Cyathocrinus ellipticus.
,, geometricus.
,, pinnatus.
,, variabilis.
Actinocrinus polydactylus.
,, triacontadactylus.
Amplexus nodulosus.
,, Sowerbii.
Turbinolopsis Celtica.
,, pauciradialis.
Manon cibrosum ?
Pleurodictyum problematicum ?
Verticillopora abnormis ?
Millepora gracilis.
Gorgonia assimilis.
Glauconome bipinnata.
,, pluma.
Fenestella oculata.

Ballyduff.

Goniatites excavatus.
,, Listeri.

COUNTY WATERFORD, *continued.*

DUNGARVAN, *continued.*

Ballyduff, continued.

Goniatites obtusus.
,, ovatus.
Temnocheilus pinguis.
,, sulciferus.
Bellerophon apertus.
Naticopsis Phillipsii.
Pleurorhynchus minax.
Arca fimbriata.
Pecten dissimilis.
,, ellipticus.
,, fallax.
,, gibbosus.
,, plicatus.
,, Sowerbii.
Calceola sandalina.
Producta laciniata.
,, lirata.
,, pectinoides.
,, rugata.
Leptæna Hardrensis.
Orthis divaricata.
,, longisulcata.
Cyrtia cuspidata.
Brachythyris ovalis.
Cythere inflata.
Amplexus tortuosus.
Stromatopora polymorpha.

Vicinity of.

Temnocheilus tuberculatus.

Clonea.

Euomphalus serpens.
Pecten transversus.
Producta caperata.
,, fragaria.
,, prælonga.
Leptagonia analoga.
Leptæna plicata.
Orthis filiaria.
,, granulosa.
,, parallela.
,, semicircularis.
Spirifera aperturata.
Spirifera attenuata.
,, disjuncta.
,, ostiolata.
,, rotundata.
Cyrtia nuda.
Martinia decora.
,, glabra.
,, phalæna.
Athyris decussata.
,, globularis.
Atrypa desquamata.
,, insperata.
,, oblonga?
,, striatula.
Calymene lævis.
,, Latreillii.
Echinocrinus glabrispina.
Taxocrinus macrodactylus.
Cyathocrinus pinnatus?
,, variabilis.
Actinocrinus tenuistriatus.
,, tesselatus.
Amplexus nodulosus.
,, Sowerbii.
,, tortuosus.
Turbinolopsis Celtica.
Manon cribrosum?
Pleurodictyum problematicum.
Favosites fibrosa.
Verticillopora abnormis.
Millepora gracilis.
Fenestella laxa.

TALLOW.

Camphire.

Plants.

Janeville.

Plants.

Tallowbridge.

Sphenopteris Hibernica.
Lepidodendron Griffithii.
Cyclostigma, Stigmaria, &c.

Vale of the Bride.

Plants.

County Wexford.

FETHARD.

Hook Head.

Acroculia triloba.
,, tubifer.
,, vetusta.
Pleurorhynchus aliformis.
Pecten fallax.
Producta caperata.
,, corrugata.
,, pugilis.
,, pustulosa.
,, quincuncialis.
,, setosa.
Leptagonia nodulosa.
Leptæna convoluta.
,, Hardrensis.
Orthis crenistria.
,, interlineata.
,, parallela.
Spirifera attenuata.
,, bisulcata.
,, calcarata.
,, gigantea.
,, ostiolata.
,, rhomboidea.
,, speciosa.
Cyrtia cuspidata.
,, distans.
,, laminosa.
,, mesogonia.
,, semicircularis.
,, simplex.
Martinia plebeia.
Reticularia imbricata.
,, microgemma.
Brachythyris pinguis.
Athyris concentrica.
,, decussata.
,, depressa.
,, squamosa.
Atrypa fallax.
,, hastata.
Phillipsia truncatula.
Spirorbis caperatus.
Spiroglyphus marginatus.
Palæchinus elegans.
,, gigas.
Echinocrinus elegans.
,, glabrispina.
,, vetustus.
Platycrinus laciniatus.
,, lævis.
,, ornatus.
,, triacontadactylus.
Poteriocrinus gracilis.
Cyathocrinus tuberculatus.
Atocrinus Milleri.
Amplexus Sowerbii.
,, tortuosus.
Turbinolia fungites.
Siphonophyllia cylindrica.
Lithodendron sexdecimale.
Aulopora campanulata.
Astreopora antiqua.
Dictyophyllia antiqua.
Favosites polymorpha.
Berenicea megastoma.
Ptylopora pluma.
Polypora dendroides.
Acroculia tubifer.
Athyris squamosa.
Psammodus porosus.

Catalogue of the several Localities in Ireland where Mines or Metalliferous Indications have hitherto been discovered, arranged in Counties, according to their respective Post Towns.

Note.—The localities with an asterisk prefixed are situate in Igneous or Lower Sedimentary Rocks; the remainder occur for the most part in Limestone. **Mines *now* or *formerly*** worked are printed in Italics, but no opinion as to the relative or actual productiveness of any is intended to be offered; subdenominations of Mineral districts are grouped for convenience between brackets; when Mines have been recognized by other designations, these latter are added in parentheses. The numbers attached to the localities refer to the Ordnance Sheets which contain them. Several authorities and explanatory remarks are interspersed. Collieries are omitted, the Coal-fields being described in Sir Richard Griffith's Reports, and marked on his Geological Map of Ireland, from which the following localities were originally compiled, many years ago, for the use of the General Survey and Valuation of Ireland.

Though Metallic Lodes have not been discovered in the Counties of Carlow, Londonderry, and Westmeath, it is not improbable that such may occur.

Post Towns.	Localities and Counties.	No. of Ordnance Sheet.
	ANTRIM.	
BALLYCASTLE, ...	Coal-field (Ballynagard, Torglass, Tornaroan, &c.), Clay-ironstone, and Hematite,	5 & 9
CARRICKFERGUS, . . .	*Duncrue*, thick beds of Rocksalt, also Gypsum on Coast from Belfast, Northward, .	52
LARNE, ...	*Dundressan, Iron,†	41
	ARMAGH.	
BELLEEK, ... *Drumnahoney Mines*, .	**Carrickgallogly*, Lead, — Griffith, MSS., Mines of Ireland, 1821, ...	25
	**Drumnahoney*, Lead, ...	25
CROSSMAGLEN, ...	*Dorsy, Lead,—discovered by Joseph Backhouse, of London, Esq., ... : .	28
	*Tullyard, Lead, ...	30
	*Tullydonnell, Copper, ...	31
KEADY, ...	*Aughnagurgan, Lead, ...	20
	**Clay*, Lead and Manganese, ...	19
	**Doohat or Crossreagh*, Lead,—communicated by William Conn, Esq., ...	19
	**Drummeland(Derrynoose)*,—Lead, worked by the late Lord Farnham many years ago, ...	19
MIDDLETOWN, ...	**Tamlaght*, Lead, ...	15
NEWRY, ...	*Drumbanagher (Church Glen), Lead, .	22
	**Kilmonaghan (Jerrets or Tuscan Pass)*, Copper, ...	22
NEWTOWNHAMILTON, .	**Ballintemple*, Lead, — communicated by Joseph Backhouse, Esq., ...	25
POINTZPASS, ...	**Ballymore*, Lead,—exact position not ascertained, ...	18, &c.

† When the word Iron occurs alone, Magnetic, Specular, or other Ores (proper), of Iron are those intended; thus distinguishing them from the Clay-ironstone, a regular rock formation.

Post Towns.	Localities and Counties.	No. of Ordnance Sheet.
	CAVAN.	
CAVAN, ...	*Farnham Demesne, Copper, ...	20
COOTEHILL, ...	* *Cornanurney* (*Wheal Burrowes*), Lead, .	22
SHERCOCK, ...	*South East of, Lead, ...	29, &c.
SWANLINBAR, ...	*Cuilcagh District*, Clay-ironstone,—Griffith's Coal Reports, ...	6
	CLARE.	
BALLYVAGHAN, . . .	Cappagh, Copper, Argentiferous Lead, and Manganese, ...	6
FEAKLE, ...	*Corrakyle, Copper, ...	20
	*Glendree, Lead, ...	19 & 27
	*Leaghort, Copper,—communicated by R. Purdy Allen, Esq., Sec. to the Mining Company of Ireland, ...	20
NEWMARKET-ON-FERGUS,	*Carrownakilly*, Argentiferous Lead, . .	42
QUIN, ...	*Ballyhickey*, Argentiferous Lead, and Copper, with Zinc, ...	34
Castletown Mines, . .	*Castletown*, Lead, ...	34
	Moyriesk, Argentiferous Lead, ...	34
	Monanoe (*Kilbreckan*), Argentiferous Lead, and Antimony,—Kilbreckanite, . . .	34
ROADFORD, ...	*Crumlin*, Argentiferous Lead, ...	4
	Doolin, Argentiferous Lead, ...	8
SIXMILEBRIDGE, . . .	Rathlaheen South, Lead and Sulphur Ore, —communicated by R. W. Townsend, Esq.	51
TOMGRANEY, ...	* *Ballyhurly*, Lead, Griffith's MSS., Mines of Ireland, ...	29
TULLA, ...	Ballyvergin, Lead, Copper and Sulphur Ore, —communicated by R. W. Townsend, Esq.,	26
	Knockaphreagaun (*Crow Hill*), Argentiferous Lead, ...	34
	Milltown, Silver and Lead,—worked by the Bullion Mining Company, ...	35
	CORK.	
BALLYDEHOB, ...	* *Ballycummisk*, Copper,—see Griffith's Report on Audley Mines, ...	140
Audley Mines, . . .	* *Cappaghglass* (*Cappagh*), Copper, . .	140
	* *Foilnamuck*, Copper, ...	140
	* *Horse Island*, Copper, Traces of Lead occur in the Gossans of all these mines, .	149
	* *Rossbrin*, Copper, ...	140
Ballydehob Mines, . .	* *Ballydehob*, Copper, worked by South Cork Mining Company, ...	140
	* *Boleagh*, Copper, ...	140
	* *Cooragurteen*, Copper, ...	140
	* *Kilcoe*, Copper, ...	140
	* *Skeaghanore*, Copper, ...	140
	* *Derreennalomane*, Copper, ...	131

Post Towns.	Localities and Counties.	No. of Ordnance Sheet.
	CORK, *continued.*	
Roaringwater Mines, .	*Kilkilleen, Copper and Lead, ...	140
	*Laheratanvally, Copper and Lead, . .	140
	*Leighcloon, Copper, ...	140
BANTRY, ...	**Carravilleen*, Copper, ...	129
	**Clashadoo (Four-Mile-Water)*, Copper, .	130
	*Derreengreanagh, Copper and Sulphate of Barytes,—communicated by R. W. Townsend, Esq., ...	118
	**Glanalin*, Copper, ...	129
	**Gortavallig*, Copper, ...	188
Hollyhill Mines, . .	**Gortacloona*, Lead, ...	118
	**Hollyhill*, Copper, ...	118
	**Killeen*, Copper, ...	129
	**Killoveenoge*, Argentiferous Lead, . . .	117
	**Rooska, East*, Argentiferous Lead, . . .	117
CARRIGTOHILL, . . .	*Vicinity of*, Lead with Zinc,—Mr. Courtney's Estate, ...	75 & 76
CASTLETOWN-BEARHAVEN, ...	**Allihies*, Copper,—Griffith, MSS., . . .	114
	**Cahermeeleboe*, Copper, ...	127
Bearhaven Mines, . .	**Caminches*, Copper, ...	114
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	**Coom*, Copper, ...	114
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Post Towns.	Localities and Counties.	No. in Ordnance Map.
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IX.—On the Blowpipe Characters of Minerals. By Aquilla Smith, M. D., Fellow of the King and Queen's College of Physicians in Ireland.

[Read June 13, 1860, and edited by the President and Secretary.]

Acmite, bacillary (Th.* 479).—Rundemyr, Norway. Hardness nearly = 6·0; streak whitish. In the forceps fuses readily and quietly into a brilliant black globule. No water. With borax fuses very slowly, and tinges glass with iron.

Actinolite (*Vide* **Hornblende**).—Glen Elg, Scotland. In the forceps fuses rather slowly into a dark green globule. No water. With borax emits a few bubbles, and fuses rather readily into a glass, coloured by iron while warm.

Actinolite, asbestiform.—Haytor, Devonshire. Fuses into a black globule, feebly magnetic. With borax slowly soluble.

Actinolite, glassy (Th. 196; Al.† 145).—Asbestos Strahlstein of Werner. Zillerthal, Tyrol. Hardness = 5·3. Streak white. In the forceps becomes whitish, and fuses quietly but slowly on the edge into a greyish bead, and a small fragment forms a globule with difficulty; in the inner flame it effervesces and intumesces much. No water. With borax it fuses rather slowly into a glass, coloured by iron while warm.

Æschynite.—Miask, Siberia. Hardness = about 5·5; yields with difficulty to the knife; streak pale yellow; translucent in the fragments; does not scratch glass. In the forceps intumesces suddenly, and becomes yellow; it then fuses into a dull iron-black globule, not magnetic. Contains a little water. With borax dissolves into a clear glass, slightly coloured by iron while warm. No manganese with nitre.

Note.—Could not detect titanium by fusing it with bisulphate of soda and adding tin.

Albin, crystallized (*Vide* **Apophyllite**). (Th. 352; Al. 130).—Aussig, Bohemia. Yields easily to the knife. In the forceps fuses on the surface slowly, with slight effervescence scarcely perceptible, into a rough blebby enamel, but does not form a bead. Contains much water. With borax effervesces at first, and fuses rather slowly into a colourless glass, which does not become opaque by flaming even when saturated; with acetate of cobalt becomes blue.

Allagite (*Vide* **Rhodonite**).—Schelenholz, in the Hartz. Hardness = 5·5; streak white. In the forceps fuses readily on the edge, with some effervescence, into a greyish blebby glass. No water. With borax emits some bubbles; dissolves slowly, and in the outer flame indicates manganese.

[**Allanite.**—In forceps fuses readily into a black bead; with borax dis-

* Outlines of Mineralogy, Geology, and Mineral Analysis. By Thomas Thomson, M. D. 2 vols. 8vo. London, 1836. The references are to vol. i.

† Manual of Mineralogy. By Robert Allan. 1 vol. 8vo. Edinburgh, 1834.

flected light; in the reducing flame it becomes opaque, and the reflected colour is darker when cold, and the transmitted colour has a bluer shade. It cannot be rendered colourless in the inner flame, like Brookite; a little nitre discharges the colour. With salt of phosphorus it dissolves with great difficulty; the glass is yellow while warm, pale amethyst colour when cold.

Anatase.—Wheal Virtuous Lady, Tavistock, Devonshire. Hardness = 5·0 –5·5; streak white. In the forceps infusible. With borax fuses rather readily, and appears as if coloured by iron in the oxidating flame; in the reducing flame it becomes brown; its transparency may be restored in the outer flame, and it becomes opaque by flaming.

Andalusite, massive (*Vide* **Chiastolite**). (Th. 231; Al. 164).—Lugduff mountain, near Luganure, County Wicklow. Resists the file; hardness about 7·5. In the forceps it is infusible, but becomes white; with nitrate of cobalt it becomes blue; and with borax it is nearly infusible.

Anorthite (*Vide* **Amphodelite**). (Th. 296; Al. 138).—Vesuvius. Brittle; resists the knife. In the forceps fuses on the edge into a very transparent glass; a small thin fragment may be fused into a globule. No water. With borax it fuses slowly into a colourless glass.

Anthophyllite (*Vide* **Hornblende**). (Th. 206; Al. 107).—Hardness about = 5·5; streak white. Fuses with some difficulty on the edge. No water. With borax fuses very slowly into a glass, coloured with iron.

Anthophyllite, lamellar (Th. 206; Al. 107).—Ujordlersoak, Baffin's Bay. Hardness = 5·5. Streak white. In the forceps fuses on the edge, with some intumescence and effervescence, into a greenish glaze; a small fragment forms a bead. No water. With borax emits a few bubbles, and fuses slowly into a glass coloured slightly by iron.

Antimony, nickeliferous sulphuret of.—Gozenbach, Siegen. Hardness = 5·0. Powder dark iron-grey. On charcoal it emits some white fumes, with slight pungent odour, and fuses readily into a black bead, not magnetic; it is brittle, and breaks with metallic lustre. This bead, fused with borax, colours it deep blue in the outer flame, and alloys with the platina wire, in the inner flame the blue colour is changed into a brownish amethyst shade.

Antimony, red (Ph. 347; Th. 87).—Hungary. Yields very easily to the knife, streak dark red. Heated on charcoal it fuses speedily into a black vitreous mass; emits fumes of sulphurous acid; is entirely volatilized; and deposits a white sublimate on the charcoal. Hydrosulphuret of ammonia added to the sublimate converts it into an orange-yellow colour.

Antimony, sulphuret of (Ph. 345, Th. 86).—Felsobanya, Hungary. Yields very easily to the knife. Streak dark grey. On charcoal fuses very readily into a black vitreous mass, emits fumes of sulphurous acid, and then deposits a white sublimate on the charcoal, and is entirely volatilized.

Antimony, sulphuret of, compact variegated.—Golderonach, near Bayreuth, Franconia. Decrepitates violently when heated; but when reduced to powder and moistened, it affords same pyrognostic character as the last.

Antimony, white (Ph. 348; Th. 83).—Very rare. Yields very easily to the knife. Heated on charcoal, it decrepitates a little; fuses speedily into a fluid globule; volatizes without odour, and deposits white sublimate. On the charcoal a drop of hydrosulphuret of ammonia added to the white sublimate converts it to an orange-yellow colour after a few minutes.

Apatite (*Vide* **Asparagus Stone, Lime, Phosphate of**). (Th. 124; Al. 27).—Ehrenfriedersdorf, Saxony. In the forceps fuses with some difficulty on the edge. No water. With borax fuses very slowly into a colourless glass, which becomes opaque by flaming, when only a small quantity of the assay is dissolved.

[**Apatite.**—Dalkey. In the forceps infusible, glows brilliantly. With borax, dissolves slowly; bead clear in reducing flame, becomes opaque in the ordinary flame, and coloured by manganese.—Ed.]

Apophyllite (*Vide* **Albin**). (Th. 352; Al. 129).—Karartut, Disko Island, Greenland. Hardness about = 5·0. In the forceps, at a low heat, it becomes white, exfoliates, intumesces much, and fuses readily with effervescence into a blebby globule, colourless. Contains much water. With borax it effervesces at first, and fuses readily into a colourless glass, which, when saturated, I could not render opaque by flaming. Berzelius says it becomes opaque by flaming. With acetate of cobalt it melts into a blue glass; reduced to powder, it gelatinizes with nitric acid.

Arendalite (*Vide* **Epidote**). (Th. 364; Al. 150).—Arendal, Norway. Resists the knife. In the forceps intumesces and effervesces, and fuses into a scoria, which, in a strong heat, is converted into a shining black globule, not magnetic. Contains no water. With borax fuses readily into a glass coloured by iron.

Arragonite.—Kannick, Greenland. Effervesces briskly with muriatic acid. In forceps does not fall to powder; infusible. No water. With borax dissolves speedily.

Arragonite, fibrous.—Cornwall. With nitrate of potash gives indication of manganese. Contains 1·03 per cent. of manganese.

Arragonite, macled (Th. 117; Al. 30).—Molina, Arragon, Spain. Effervesces briskly with muriatic acid. In the forceps it becomes white, falls to powder immediately on being heated, and is infusible. Contains no water. With borax it fuses speedily with much effervescence into a colourless glass, which becomes opaque by flaming if a larger portion be added.

Arsenic, native (Ph. 260; Th. 79).—Idria, Carniola. Its fresh fracture presents a tin-white appearance, but it very soon tarnishes on exposure to the air. Hardness about = 3·5. Streak metallic. Heated on charcoal, it emits copious greyish fumes of strong arsenical odour, and is entirely volatilized.

Arsenic, red sulphuret of (*Vide* **Realgar**). (Ph. 281; Th. 81).—Tran-

Antimony, sulphuret of, compact variegated.—Golderonach, near Bayreuth, Franconia. Decrepitates violently when heated; but when reduced to powder and moistened, it affords same pyrognostic character as the last.

Antimony, white (Ph. 348; Th. 83).—Very rare. Yields very easily to the knife. Heated on charcoal, it decrepitates a little; fuses speedily into a fluid globule; volatizes without odour, and deposits white sublimate. On the charcoal a drop of hydrosulphuret of ammonia added to the white sublimate converts it to an orange-yellow colour after a few minutes.

Apatite (*Vide* **Asparagus Stone, Lime, Phosphate of**). (Th. 124; Al. 27).—Ehrenfriedersdorf, Saxony. In the forceps fuses with some difficulty on the edge. No water. With borax fuses very slowly into a colourless glass, which becomes opaque by flaming, when only a small quantity of the assay is dissolved.

[**Apatite.**—Dalkey. In the forceps infusible, glows brilliantly. With borax, dissolves slowly; bead clear in reducing flame, becomes opaque in the ordinary flame, and coloured by manganese.—Ed.]

Apophyllite (*Vide* **Albin**). (Th. 352; Al. 129).—Karartut, Disko Island, Greenland. Hardness about = 5·0. In the forceps, at a low heat, it becomes white, exfoliates, intumesces much, and fuses readily with effervescence into a blebby globule, colourless. Contains much water. With borax it effervesces at first, and fuses readily into a colourless glass, which, when saturated, I could not render opaque by flaming. Berzelius says it becomes opaque by flaming. With acetate of cobalt it melts into a blue glass; reduced to powder, it gelatinizes with nitric acid.

Arendalite (*Vide* **Epidote**). (Th. 364; Al. 150).—Arendal, Norway. Resists the knife. In the forceps intumesces and effervesces, and fuses into a scoria, which, in a strong heat, is converted into a shining black globule, not magnetic. Contains no water. With borax fuses readily into a glass coloured by iron.

Arragonite.—Kanniok, Greenland. Effervesces briskly with muriatic acid. In forceps does not fall to powder; infusible. No water. With borax dissolves speedily.

Arragonite, fibrous.—Cornwall. With nitrate of potash gives indication of manganese. Contains 1·03 per cent. of manganese.

Arragonite, macled (Th. 117; Al. 30).—Molina, Arragon, Spain. Effervesces briskly with muriatic acid. In the forceps it becomes white, falls to powder immediately on being heated, and is infusible. Contains no water. With borax it fuses speedily with much effervescence into a colourless glass, which becomes opaque by flaming if a larger portion be added.

Arsenic, native (Ph. 280; Th. 79).—Idria, Carniola. Its fresh fracture presents a tin-white appearance, but it very soon tarnishes on exposure to the air. Hardness about = 3·5. Streak metallic. Heated on charcoal, it emits copious greyish fumes of strong arsenical odour, and is entirely volatilized.

Arsenic, red sulphuret of (*Vide* **Realgar**). (Ph. 281; Th. 81).—Tran-

sylvania. Soft, brittle. Streak orange-yellow. On charcoal it burns with a bluish flame; emits copious sulphureous fumes, and a slight odour of arsenic.

Arsenic, yellow sulphuret of (*Vide* **Orpiment**). (Ph. 283; Th. 82).—Transylvania. Very soft. Powder bright yellow. On charcoal it burns with a bluish flame, emits fumes of sulphurous acid, and is entirely volatilized.

Arsenical Iron (Ph. 213).—Faithleg, Waterford. Hardness = 6. On charcoal it emits copious arsenical fumes, and fuses readily into a magnetic bead.

Arsenical Iron (Ph. 213).—Haytor Mine, Devonshire. Yields with some difficulty to the knife. Hardness = 5·5. Heated on charcoal, it emits copious arsenical fumes, and melts into a shining porous gray globule, attracted by the magnet.

Arsenical Iron.—Johanngeorgenstadt, Saxony. Hardness about = 5·5; streak shining; powder greyish-black. On charcoal it very soon emits fumes of arsenic, and becomes magnetic; it forms a bead with difficulty, even in the forceps.

Arsenical Iron, massive.—Hardness = 5·5; streak greyish-black. On charcoal it emits arsenical fumes readily and copiously, and fuses into a dark grey irregular scoria, which is magnetic; and when transferred to the forceps, forms a bead with difficulty. Does the difficulty of forming a bead by fusion depend on its containing less sulphur than other specimens?

[**Asbestus** (*Vide* **Hornblende**).—In the forceps fuses readily into a yellow-coloured opaque bead, with a narrow neck. No water. With borax dissolves readily into a colourless transparent bead. With microcosmic salt dissolves slowly, and leaves no siliceous skeleton.—Ed.]

Asparagus Stone (*Vide* **Apatite**).

Augite, black (*Vide* **Pyroxene**). (Th. 190; Al. 143).—Arendal, Norway. Hardness nearly = 5·0; streak greenish. In the forceps fuses rather readily into a black bead. No water. With borax very slowly soluble.

Augite, black.—Ersby Pargas, Finland. Hardness near = 5·0; streak white. In the forceps in the inner flame fuses on the surface into a dark green glass, and forms a bead very slowly. No water. With borax emits a few bubbles, colours the glass with iron, and is very slowly soluble.

Augite, white (*Vide* **Pyroxene**). (Th. 187).—United States. Hardness = 5·0. In the forceps effervesces and intumesces, and fuses readily into a colourless blebby globule. No water. With borax dissolves partly at first, and leaves a residue very slowly soluble.

[The Augites dissolve in borax somewhat more easily than the Hornblendes; and in the forceps show slight traces of soda.—Ed.]

Axinite (Th. 367; Al. 191).—Dauphiné. Resists the knife. In the forceps it fuses readily, with much intumescence and effervescence, into a dark green shining globule. No water. With borax it breaks up and dissolves readily into a transparent glass, coloured by iron; with nitrate of potash it indicates the presence of manganese.

Barytes, crystallized carbonate of (Th. 101; Al. 47).—Cumberland. Effervesces feebly with nitric acid, unless when scraped, and is entirely soluble in it. In the forceps decrepitates, and fuses readily into a very fluid globule, transparent while hot, white and opaque when cold, and tinges the flame behind the assay pale greenish-yellow. With borax fuses rapidly, with effervescence, into a glass opaque when cold, if saturated with the assay.

Barytes, carbonate of (Th. 101; Al. 47).—Yorkshire. Does not effervesce with acid, unless when scraped. Hardness = 3·0. In the forceps fuses readily, *without decrepitation*, and in other respects its characters are the same as the preceding.

Barytes, sulphate of.—Hardness about = 3·5. In the forceps fuses quietly into an opaque bead, white. No water. With borax fuses quietly, and rather readily, into a colourless glass.

Barytes, sulphate of.—Does not effervesce with acid; decrepitates violently. Tinges the flame behind the assay greenish-yellow, and fuses into a white enamel. No water. With borax dissolves with continued effervescence. The effervescence with borax is probably due to the presence of some carbonate of barytes.

Barytes, sulphate of.—Glenmalure, Co. Wicklow. Does not decrepitate; fuses into a white enamel.

Barytes, sulphate of.—Isle of Sheppey. Decrepitates; colours the flame greenish-yellow; fuses into a white bead. With borax dissolves readily.

Barytes, sulphate of (Th. 103; Al. 48).—From Transylvania. Decrepitates very slightly.

Barytocalcite (of Brooke). (Th. 140; Al. 50).—Cumberland. Hardness = 3·5. Effervesces feebly with nitric acid. Decrepitates in the flame of a candle, and fuses with difficulty into a rough mass of a pale bluish-green colour. With borax effervesces much.

Barytocalcite.—Alston Moor, Cumberland. Effervesces with acid. Tinges the flame pale yellowish-green, and in a strong heat it glazes a little on the surface, and becomes pale bluish-green. With borax effervesces much, and dissolves speedily. See the latter part of Mr. Allan's observations on Barytocalcite.

Berthierite (Ph. 344; Th. 498).—Bräunsdorf, near Freiberg, Saxony. Hardness about = 3·0, or 3·5; streak dark grey. Heated on charcoal, it fuses (but not so speedily as grey antimony), emits sulphurous acid fumes, deposits a white sublimate on the charcoal, and is not entirely volatilized. A dull black globule remains, which is attracted by the magnet; when broken, a fragment of this globule fused with borax indicates iron.

Bismuth Cobalt ore (Ph. 287; Th. 534).—Bieber, Hesse. Hardness = 5·5; streak metallic, powder dark grey. Gently heated on charcoal, it emits small globules; and when the heat is increased, gives off arsenical fumes, and then fuses into a dark bead rather slowly, which is feebly magnetic. A portion of the roasted assay colours borax deep blue.

Bismuth, cupreous sulphuret of (Ph. 278).—Cornwall. Sectile, streak

tin-white. The instant it is heated, it emits white globules, sulphurous acid fumes, and, after intense roasting, a bead of pure copper; said to be found only at Wittichen.

Bismuth, native (Ph. 276; Th. 588).—St. Just, Cornwall. Sectile, streak shining. Heated on charcoal, it fuses instantly, and is entirely volatilized, depositing a yellowish sublimate on the charcoal; the colour of the sublimate is much darker while it is warm.

Bismuth, sulphuret of (Ph. 277; Th. 588).—Cornwall. Yields to the nail. Fuses readily; emits sulphurous acid smell, and is only partly volatilized; leaves a bead, which is magnetic.

Bismuth, sulphuret of (Ph. 277; Th. 589).—Lanescot Mine, Cornwall. Yields to the nail, powder dark grey, brittle. Heated on charcoal, it fuses readily into a bead, brilliant while warm, emits slight smell of sulphurous acid; is entirely volatilized, and deposits a sublimate, yellow while warm.

Blende (Ph. 371).—Luganure Mine, county of Wicklow. Hardness = 4·5. In the forceps decrepitates at first, and fuses on the edge. No water. With borax it is slowly soluble.

Bluespar (*Vide* **Lazulite**). (Th. 311).—Krieglach, Upper Styria. Yields with difficulty to the knife; streak white. In the forceps becomes white, and fuses on the edge, in a good heat, into a white enamel. Contains a trace of water. With borax effervesces a little at first, and fuses into a clear glass, slightly coloured by iron; with acetate of cobalt becomes deep blue.

Bole.—Benevenagh, Derry. Sectile, streak unaltered; marks paper faintly; does not adhere to the tongue; does not fall to pieces in water. In the forceps fuses rather readily, with slight effervescence into a dark greenish bead. Contains a good deal of water. With borax fuses rather slowly, and colours the glass with iron while warm.

Bole.—Giant's Causeway. Scratched by the nail, streak shining; marks paper strongly; adheres slightly to the tongue, and falls to pieces in water. In the forceps decrepitates, and in a good heat fuses on the edge into a black glass, not magnetic. Contains a good deal of water. With borax dissolves slowly; no manganese. Is Dr. Thompson's plinthite a variety of bole?

Bonsdorffite (*Vide* **Fahlunite**). (Th. 278 and 323).—Bodenmais, Bavaria. Translucent; yields to the knife. Hardness about = 3·5; streak white. In the forceps fuses on the edge into a greyish glass. Contains some water. With borax fuses rather slowly into a transparent glass.

Boracite (Th. 161; Al. 194).—Lüneburg, Hanover. Resists the knife. In the forceps intumesces, effervesces, and colours the *flame green* behind the assay, then fuses into an opaque yellowish-white bead. No water. With borax fuses into a transparent bead, slightly coloured by iron.

Borosilicate of Lime (*Vide* **Datholite**) (Th. 144; Al. 111).—Nodobröe, near Arendal, Norway. Rather hard; yields to the knife. In the forceps becomes white and opaque, and fuses readily, with slight intumescence and effervescence, into a transparent colourless glo-

bule, rather fluid, and tinges the flame behind the assay green. *This globule becomes opaque by flaming.* No water. With borax effervesces at first, and dissolves speedily into a colourless glass.

Botryolite (*Vide* **Datholite**). (Th. 144; Al. 111).—Arendal, Norway. Yields rather easily to the knife. In the forceps becomes white; intumesces slightly; tinges the flame green behind the assay, and fuses very readily into a globule perfectly transparent and colourless. No water. With borax dissolves readily into a clear glass.

Bournonite (Ph. 352; Th. 624).—Kapnik, Transylvania. Yields easily to the knife; streak dark grey. On charcoal, if gently heated, it fuses very readily into a dark-coloured globule, brilliant while warm; deposits on the charcoal a white sublimate in small quantity; it then disengages white fumes, which have a weak smell of sulphurous acid. In a stronger heat, it deposits a yellowish coating on the charcoal; and if the dark-coloured bead be roasted for a considerable time, a small globule of pure copper will remain, which is not equal in size to one-fourth of the assay, so that it is volatile in large proportion. This specimen appears to me to contain very little antimony, certainly much less than analysts have generally found.

Breunnerite (Th. 180; Al. 38).—Zillerthal, Tyrol. About as hard as fluor-spar. Does not effervesce with muriatic acid, even when scraped. In the forceps becomes black and magnetic, and is infusible. No water. With borax effervesces, briskly at first, and fuses speedily into a glass coloured by iron.

Brewsterite (Th. 347; Al. 128).—Strontian, Scotland. In the forceps whitens, exfoliates, curls up, and fuses rather slowly into a colourless blebby glass. Contains water. Fuses very speedily with borax.

[**Bronzite** (*Vide* **Pyroxene**).—In the forceps fusible with great difficulty on the edges. Dissolves in borax, like Coccolite, into a bead coloured by iron.—Ed.]

Brookite (*Vide* **Anatase**; **Rutile**). (Ph. 256).—Resists the knife. Hardness = 7·0. In the forceps infusible. With borax it fuses very slowly; the glass is transparent while hot; when cold, it is brick-red by reflected light, and a reddish amethyst colour by transmitted light, according to the degree of oxidation; a minute proportion produces these effects; in the reducing flame it becomes transparent, and remains so when cold, and may be rendered opaque again by careful management of the flame; nitre destroys the amethyst colour. With salt of phosphorus it becomes opaque, but requires a very intense and prolonged heat to dissolve it; the glass is opaque while hot; then becomes transparent olive-green, then blackish; and when perfectly cold, an amethyst colour by transmitted light.

Bucholzite (*Vide* **Kyanite**). (Th. 234; Al. 204).—Chester, on the Delaware, near Philadelphia. About as hard as quartz. In the forceps infusible in the smallest fragments. Contains no water. Infusible with borax; with nitrate of cobalt it becomes pale blue.

Buntkupfererz (*Vide* **Purple Copper**), (Ph. 310; Th. 662).—Alten Mines, Finmark. Its characters are very similar to purple copper. It bubbles a little while flaming.

Bustamite (*Vide* **Rhodonite**). (Th. 518).—Mexico. Hardness = 6·0 streak white. In the forceps at a low heat it blackens, and fuses slowly into a brilliant black enamel, forming a bead with difficulty. A trace of moisture. With borax dissolves readily, with some effervescence, into a glass of a reddish-purple colour.

The greenish radiated part is of hardness = 6·0. In the forceps fuses readily into a transparent globule of a pale brown colour, and effervesces a little while fusing. A trace of moisture. With borax dissolves rather readily, with effervescence, into a glass of a deep amethyst colour.

Calaite (*Vide* **Turquoise**). (Th. 230; Al. 157).—Abdool Rasakee Mine, Persia. Scarcely yields to the knife; streak white. In the forceps becomes brown, and tinges the flame green behind the assay, but it is infusible. Gives out much water. With borax fuses rather readily into a glass coloured by iron.

Calaite.—Oelsnitz, Saxony. Hardness near = 5·0; streak white. In the forceps tinges the flame pale green; becomes white, and infusible. Contains a good deal of water. With borax dissolves not very readily.

Calamine, Botryoidal electric.—Nertschinsky, Siberia. Hardness = 4·5; streak white; effervesces with nitric acid, particularly if scraped. On charcoal it is infusible; in a low heat it cracks and becomes yellow; in a stronger heat, it becomes nearly black, and the charcoal is covered with a powder which is yellow while warm. No water. With borax it emits bubbles, and dissolves readily into a glass, yellow while warm, colourless when cold.

Cerite (Ph. 262; Th. 415).—Bastnäs, in Sweden.

Cerite. Hardness = 5·0; streak white. In the forceps scintillates a little, becomes pale buff-yellow, and is infusible. A trace of moisture. With borax it effervesces at first, and dissolves rather slowly into a glass, of a deep umber colour while warm, then passes into a pale green, and is nearly colourless when cold; the glass becomes milky by flaming, if a large proportion of the assay be used.

Cerine. Colour black, hardness = 5·0; streak greyish. In the forceps fuses rather readily, with slight ebullition, into a black shining glass, not attracted by the magnet. A trace of moisture. With borax it effervesces, and dissolves rather readily into a glass, reddish while hot; greenish, as if coloured by iron, when cold. It becomes opalescent by flaming when nearly saturated.

Chabasite (Th. 333; Al. 118).—Yields rather easily to the knife; streak white. In the forceps becomes white; intumesces much, and fuses with slight effervescence into a white blebby globule. Contains much water. With borax it dissolves speedily, with slight effervescence, into a colourless glass. Does not gelatinize in nitric acid, even when heated.

Chabasite.—North of Ireland. Yields easily to the knife. In the forceps becomes white; intumesces much; and fuses into a white blebby

bead. Contains much water. With borax effervesces a little, and dissolves readily.

Chalilite (*Vide* **Thomsonite**). (Th. 324).—Benevenagh, Derry. Resists the knife. Hardness about = 5·5; translucent on the edge. In the forceps fuses quietly, and rather readily, into a transparent, colourless bead, slightly blebby. Contains much water. With borax it fuses rather readily into a glass, slightly coloured by iron while warm, and leaves a small skeleton, which dissolves slowly.

Chalcolite (Ph. 270).—Wheal Bassett, near Gwennap, Cornwall. Hardness = 2·5–3·0; streak pale green. In the forceps becomes pale green, and fuses readily, with some ebullition and intumescence, into a black semi-vitreous globule; colours the flame pale green. Contains much water. With borax it dissolves readily into a glass, green by transmitted light, reddish by reflected light.

Chiastolite (*Vide* **Andalusite**). (Al. 160).—Hof Bayreuth, Germany. Sectile. In the forceps, at a low heat, it becomes dark grey, and in a stronger heat it becomes white, and fuses on the edge into a white blebby glass; with acetate of cobalt, fuses into a blue frit. Contains a good deal of water. With borax it dissolves slowly into a colourless glass.

Childrenite (Al. 39).—Tavistock, Devonshire. Hardness about = 4; powder white. In the forceps the crystals separate, become black, and fuse into a black globule, attracted strongly by the magnet. Contains water. With borax dissolves rather readily.

Chlorite.—Glandore, Co. Cork. Sectile; streak greenish. In the forceps partly falls to pieces, and fuses into a dull black globule, feebly magnetic. Trace of moisture. With borax effervesces at first, and fuses speedily into a glass, deeply coloured by iron.

Chlorite, crystallized.—Marazion, Cornwall. Sectile. In the forceps the laminæ diverge a little; it fuses quietly into a dull black magnetic bead. Some water. With borax it effervesces at first, and fuses speedily into a glass, coloured deeply by iron.

Chloropal.—Unghwar, Hungary. Yields to the nail. In the forceps it blackens, becomes magnetic, and is infusible. Contains a little water. With borax dissolves readily. No manganese.

Chondrodite (Th. 183; Al. 193).—Sussex County, New Jersey, North America. Hardness about = 4·5; streak white. Infusible. No water. With borax dissolves rather slowly into a glass coloured by iron while warm.

Chromate of Iron (Ph. 275; Th. 482).—Shetland. Hardness = 5: streak pale brown. Infusible; does not become magnetic. With borax dissolves very slowly, and colours the glass green; the intensity of the colour increases as the glass cools.

Chromiferous Iron Ore (Ph. 275).—Croagh Hay, Croaghpatrick mountain, Mayo. Streak pale brown. In the forceps infusible. A trace of moisture. With borax it dissolves slowly; the glass is coloured bottle-green while warm, and when cold it becomes rich grass-green. It is attracted freely by the magnet.

Chrysocolla (Ph. 322; Th. 619).—Ogancos, Chili. Translucent on the edge. Yields easily to the knife; streak nearly white. Does not effervesce with cold muriatic acid; partly soluble in warm muriatic acid, leaving a white residuum. In the forceps it blackens, and the flame behind the assay is coloured green; in a stronger heat it becomes a reddish-brown, and cracks on the surface, but does not fuse. Contains a good deal of water. With borax it fuses readily, with effervescence, into a glass, green while warm, blue when cold.

Cinnabar (Th. 634).—Idria, in Carniola. Hardness = 2·0; streak red. On charcoal it burns with a blue flame, emits the smell of sulphur, and is entirely volatilized.

Cinnabar, hepatic.—Idria, in Carniola. Hardness = 2·0; streak brown. On charcoal it emits slight smell of sulphur, and is volatilized, with the exception of a carbonaceous residue.

Cinnamon stone (*vide* **Garnet**). (Th. 265; Al. 201).—Colombo, Ceylon. Hardness about equal to quartz. In the forceps fuses rather easily into a translucent green bead, not magnetic. With borax it effervesces a little at first, and fuses rather slowly into a clear glass, faintly coloured by iron while warm.

Cobalt Bloom (Ph. 289; Th. 535).—Schneeberg, Saxony. Hardness = 2·5; streak nearly white. On charcoal, when first heated, it becomes blue, then fuses readily, with some arsenical odour, into a black bead, which in a stronger heat spreads on the charcoal, and forms a scoria, which is infusible. Contains much water. A minute portion of the scoria, fused with borax, colours it deep blue. In the open tube gives off water, but no sublimate.

Cobalt Glance (Ph. 284; Th. 537).—Modum, Norway. Hardness = 5·5; streak grey. Heated on charcoal, it decrepitates feebly; at first it disengages a weak smell of sulphurous acid, then fumes of arsenic, and requires an intense heat to fuse it into a dark globule, which is feebly attracted by the magnet; a very minute fragment of the fused assay, dissolved in borax on platina wire, communicates to it a deep purple colour.

Cobalt, Goose-dung (Ph. 306).—Allement, Dauphiné, France. Soft. On charcoal it becomes black; gives off slight arsenical fumes, and fuses slowly into a dark-coloured bead, very feebly magnetic; a fragment of the bead colours borax deep blue. Contains much water. Thompson, at page 535, mentions yellow and brown cobalt ochres. This is the "Gänseköthig-erz," of the Germans.

Cobalt, massive grey (Ph. 286; Th. 533).—Bieber, Hesse. Hardness 5·5; streak shining; powder nearly black. On charcoal emits copious arsenical fumes, and leaves a small black globule, magnetic. A minute fragment colours borax deep blue.

Cobalt, massive tin white (Ph. 286; Th. 533).—Schladming, Styria. Hardness = 5·5; streak shining; powder grey. Emits copious arsenical fumes on charcoal, and fuses readily into a black globule, feebly magnetic. A minute fragment of the roasted globule colours borax deep blue.

Cobalt, Slickensides, sulphuret of.—Hardness = 5·0; powder black. On charcoal it decrepitates violently. Does not contain any water. Reduced to fine powder, and moistened, it may be fused rather readily, on charcoal, into a black globule, very feebly magnetic. Before fusing it emits fumes of sulphurous acid and weak arsenical fumes. A minute fragment of the bead colours borax deep blue.

Cobalt, tin-white (P. 286; Th. 533).—Bieber, Hesse. Hardness = 5·0; streak shining; powder grey. On charcoal speedily emits fumes of arsenic, and fuses readily into an iron-grey globule, not magnetic. A minute portion of the fused globule colours borax a deep blue.

Cobalt, tin white (Ph. 286; Th. 533).—Wittichen, Baden. Emits copious arsenical fumes, and fuses into a globule which is magnetic; in other respects same as last.

Coccolite (*Vide* **Pyroxene**). (Th. 190; Al. 143).—Arendal, Norway. Yields with some difficulty to the knife. In the forceps fuses on the edge, with effervescence, into a greenish translucent glass. No water. With borax it is very slowly soluble. A minute fragment forms a bead.

Colophonite (*Vide* **Garnet**). (Th. 147; Al. 200).—Arendal, in Norway. Resists the knife. In the forceps fuses readily, with much intumescence and effervescence, into a shining dark-brown globule, not magnetic. No water. With borax breaks up, and fuses readily, with slight effervescence, into a glass, deeply coloured by iron. Contains some manganese.

Columbite (*Vide* **Tantalite**). (Ph. 272; Th. 484).—Resists the knife. Decrepitates in the flame of candle in a strong heat; glazes on the edge. Some moisture. With borax emits a few bubbles; breaks up into minute greenish fragments, and dissolves slowly into a glass, coloured by iron, which, if saturated, becomes greyish-opaque by flaming. No manganese or tungsten.

Copper, acicular muriate of (Ph. 325).—Remolinos, Chili. Streak greenish-white. On charcoal it decrepitates; powdered and moistened, it colours the flame green and blue, and is reduced readily to metallic grains. Contains much water.

Copper, antimonial grey.—Crinnis Mine, Cornwall. Yields easily to the knife: brittle. On charcoal it decrepitates violently, but when reduced to a fine powder, and moistened, it fuses readily, with some ebullition and scintillation, into a dark scoriaceous bead, attracted feebly by the magnet. While fusing it emits sulphurous acid fumes, and deposits a white powder, which becomes orange when moistened with hydro-sulphuret of ammonia. It is scarcely reducible *per se* on charcoal, but with carbonate of soda it soon yields a malleable globule.

Copper, black oxide of (Th. [illegible]; Ph. [illegible]).—Knockmahon Mines, Waterford. Yields to the knife easily. On charcoal emits some sulphurous fumes and fuses readily with some ebullition into a dark grey globule, not magnetic, and when well roasted it yields a bead of copper. It contains some water.

Copper, blue carbonate of (Ph. 319; Th. 618).—Chessy, near Lyons, France. Yields easily to the knife; hardness about = 4; streak pale blue. It effervesces with muriatic acid, particularly when scraped. On charcoal it blackens, then fuses rather readily, with some ebullition, into a dark-grey bead, which consists of red oxide of copper, as is evident by powdering it; and, when well roasted, a globule of pure copper is obtained. It contains some water. It is not so readily reduced as the red oxide.

Copper, fibrous green carbonate of (Ph. 320; Th. 602).—Knockmahon Mines, Waterford. Yields easily to the knife; streak pale green. Effervesces with muriatic acid. On charcoal it blackens, and fuses quietly into a bead, which affords metallic copper much sooner than the blue carbonate. It contains a good deal of water.

Copper Glance (Ph. 308; Th. 599).—Botallack mine, Cornwall. Sectile. On charcoal fuses readily, with some ebullition and scintillation, into a dark grey bead, not attracted by the magnet. While fusing it emits slight smell of sulphurous acid; and when well roasted, a globule of metallic copper will be found on breaking the assay.

Copper, massive Vitreous Sulphuret of (*Vide* **Copper Glance**), (Ph. 388; Th. 599).—Knockmahon Mines, Co. Waterford. Sectile; powder black. On charcoal fuses readily, with some ebullition and scintillation, into a dark grey globule, feebly attracted by the magnet. Gives off slight sulphurous smell; and when roasted, a globule of copper will be found on breaking the assay.

Copper, oblique prismatic arseniate of (Ph. 331).—Cornwall. Streak bluish-green. On charcoal it melts very speedily into a fluid mass; emits smell of arsenic, and gives a bead of copper when well roasted. It contains water.

Copper, octohedral arseniate of (Ph. 329).—Ting Tang, Cornwall. Yields easily to the knife; streak nearly white. On charcoal, at a low heat, it becomes green, then black, and fuses into a black scoria; disengages a slight smell of arsenic; and when well roasted, it yields grains of copper. Contains much water.

Copper ore, grey.—Gross Kogel, Tyrol. Brittle; yields easily to the knife; colour of cut surface bright lead grey. On charcoal it decrepitates violently, but when reduced to a fine powder and moistened, it fuses readily, with some ebullition and scintillation, into a dark scoriaceous bead, attracted feebly by the magnet. While fusing, it emits sulphurous acid fumes, and deposits a white powder, which becomes orange when moistened with hydro-sulphuret of ammonia. It is scarcely reducible *per se*, or charcoal, but with carbonate of soda it soon yields a malleable globule. In the open tube it decrepitates, emits acid fumes, and deposits a white powder, which becomes orange with hydro-sulphuret of ammonia.

Copper, phosphate of (Ph. 327).—Liebethen, Hungary. Yields easily to the knife; streak greenish. On charcoal it fuses readily, with ebullition, into a dark shining bead, which, when well roasted, emits a flash of light; when congealing, it then yields a bead of copper. Contains a little water.

Copper, plush-like Arseniate of (Ph. 332).—Cornwall. On charcoal it speedily fuses, with ebullition, into a fluid mass; emits copious fumes of arsenic, and is very soon reduced into a metallic bead. Contains a trace of water.

Copper, purple (*vide* **Buntkupfererz**). (Ph. 310; Th. 622).—Moldawa, Banat. Brittle, sectile; colour of cut surface, pale copper-red. On charcoal it fuses readily, without ebullition, into a dark grey globule, attracted by the magnet. While fusing, it emits a sulphurous smell; and when well roasted, a globule of copper.

[**Copper pyrites.**—Roasted on charcoal, forms a globule readily, which, when dissolved in borax, adding nitre, proves the presence of abundant iron, by the green colour of the bead when warm; and of copper, by its intense blue when cold.—Ed.]

Copper, red oxide of (Ph. 316; Th. 598).—Cornwall. Hardness about = 4; streak red. On charcoal it fuses readily, and is speedily reduced. In the forceps it colours the flame green, and is reduced.

Copper, rhomboidal arseniate of (Ph. 330).—Cornwall. On charcoal it decrepitates, and is reduced to very minute scales; but if very slowly heated, it fuses into a dark scoria. Emits some arsenical odour; and when well roasted, it yields grains of copper. No water.

Copper, right prismatic arseniate of (Ph. 332).—Cornwall. Streak nearly white. On charcoal emits smell of arsenic; fuses readily into a fluid mass, and is very soon reduced into a metallic globule. No water.

Cork, mountain (*Vide* **Hornblende**). (Th. 208; Al. 147).—In a low heat it becomes orange-red, and fuses readily, with very slight effervescence, into a shining black bead. Contains some water. With borax fuses readily into a clear glass, coloured by iron. No manganese.

Corundum (*Vide* **Emery**) (Th. 211; Al. 167).—East Indies. Scratches steel readily. In the forceps it is quite infusible. Almost infusible with borax. Heated with solution of nitrate of cobalt, it becomes blue.

Corundum, crystallized.—Mozzo, in Piedmont. Scratches topaz. In the forceps it becomes white, and is infusible. With nitrate of cobalt it becomes blue. Contains a trace of water, and is almost infusible with borax.

Crucilite (Th. 435).—Clonmel, Co. Tippérary. It is soft. In the forceps fuses on the edge into a grey glaze, and becomes highly magnetic. It contains a good deal of water. The crucilite is decomposed arsenical iron.

Cryolite (Th. 251; Al. 22).—Ivakœet, Arkuts Fiord, South Greenland. Yields easily to the knife; nearly as hard as calc spar. Does not fuse in the flame of a candle; on charcoal fuses readily into a very fluid colourless globule, which becomes white and opaque when cold; and if kept for a short time in the reducing flame, it is converted into a white infusible scoria. With nitrate of cobalt the scoria becomes blue. Contains no water. With borax it fuses

speedily into a colourless bead, which becomes opaque on cooling, if it be saturated; and at a certain point of saturation, if cooled slowly, small rectangular crystals may be observed. A little of the powder with sulphuric acid, heated on a piece of platina foil, corrodes a piece of glass placed over it.

Cyprine (*Vide* **Idocrase**) (Th. 262; Al. 198).—Souland, Tellemarkin, Norway. Very brittle; yields to the knife; streak white. In the forceps it fuses readily, with intumescence and effervescence, into a muddy-green bead, red at its base, and colours the flame behind the assay a rich yellowish-green. No water. With borax it breaks up, and fuses speedily into a clear glass, coloured by iron while warm. A fragment fused with borax, and touched with nitrate of potash, indicates the presence of manganese. Berzelius and Thompson have omitted to notice the very characteristic colour given to the flame behind the assay. Although Berzelius has not mentioned it, he probably observed it, and was on that account induced to name it "Cupriferous Idocrase." Dr. Thompson could not detect copper, and I also failed to detect it by reagents with the blowpipe.

Datholite (*Vide* **Botryolite**; **Borosilicate of Lime**).

Diallage (Th. 173.)—The Lizard, Cornwall. Hardness about = 3; streak white. In the forceps fuses on the edge slowly. Contains water With borax fuses slowly [with effervescence—Ed.] into a glass coloured by iron.

Diaspore (*Vide* **Alumina, hydrated**).—In the forceps decrepitates slightly; blackens at first, and in a strong heat becomes white like enamel, but is infusible. With acetate of cobalt becomes blue. Gives off some water in the matrass. With borax effervesces a little at first, becomes white, tinges it faintly with iron while warm, and fuses very slowly. Entirely, but very slowly, soluble with bisulphate of soda.

Dichroite (*Vide* **Iolite**). (Th. 277; Al. 177).—Eric Matts, Sweden. Resists the knife. In the forceps fuses on the edge into a greyish blebby glass. No water. With borax emits some bubbles, and fuses rather slowly into a colourless glass.

Dipyre (Th. 271; Al. 139).—Mauléon, Pyrenees. Hardness about = 4·0. In the forceps it fuses with effervescence, and some intumescence, into a blebby greyish globule. Contains a little water. With borax fuses, with continued effervescence, into a glass slightly coloured by iron.

Dolomite.—From Mountrath, Queen's County. Scarcely as hard as calc spar. Effervesces briskly with nitric acid. In the forceps fuses on the edge into a greyish blebby translucent glass. No water. With borax effervesces briskly, and dissolves speedily. Contains a little iron. Heated with nitric acid, it leaves a large insoluble residue.

Edelite (*Vide* **Prehnite**) (Th. 317).—Tyrol. This mineral consists of two distinct substances—the dark red, or central portion, and the pale red fibrous portion.

The dark red central portion yields to the knife with difficulty; streak white. Hardness about = 5·5. Does not effervesce with muriatic acid. In the forceps it becomes white, and fuses, or rather only glazes, on the edges. With nitrate of cobalt it becomes blue. Contains much water. With borax it dissolves very slowly into a colourless glass.

The pale red fibrous portion yields very easily to the knife; streak white. Effervesces briskly with muriatic acid. Contains some water. In the forceps glazes on the edge, and becomes alkaline. With borax it effervesces much, and fuses very quickly into a transparent glass, feebly coloured by iron. It dissolves in large quantity, and cannot be made opaque by flaming.

Edenite.—North America. Yields to the knife. Hardness about = 5·5. In the forceps intumesces and effervesces much, and fuses rather readily into a very pale bluish globule, slightly blebby and transparent. No water. With borax fuses rather slowly into a transparent glass slightly tinged with iron.

Egeran (*Vide* **Idocrase**) (Th. 259).—Eger, near Haslau, Bohemia. Its characters correspond with Norway Idocrase, except that it does not contain manganese.

Elæolite (*Vide* **Nepheline**). (Th. 363; Al. 142).—Stavern, Norway. Hardness about = 6·0; streak white. In the forceps soon fuses on the edge into a blebby colourless glass, but forms a bead slowly. No water. With borax it dissolves very slowly; reduced to powder, and moistened with nitric acid, it gelatinizes speedily.

Emery (*Vide* **Corundum**). (Th. 211; Al. 167).—East Indies. Its characters are the same as Corundum.

Emery—Ochsenkopf, near Schneeberg in Saxony. Scratches quartz readily. Magnetic. In the forceps, in a good blast, it fuses into a black magnetic slag. With borax the iron dissolves, leaving a large residue.

Emmonite (*Vide* **Strontian, carbonate of**).—Massachussets. Hardness = 3·0. Effervesces with nitric acid, and otherwise corresponds with the characters of carbonate of strontian. Thompson's Records of Science, June, 1836, p. 414.

Epidote (*Vide* **Arendalite; Zoisite**). (Th. 364; Al. 150).—From Bourge D'Oisans, Dauphiné. Resists the knife. In the forceps intumesces, and fuses readily into a brown scoria, which, in a good heat, melts into a brilliant black bead; not magnetic. No water. With borax it breaks up, and fuses rather readily into a clear glass coloured by iron.

Epidote.—Knockmahon Cliffs, County Waterford. In the forceps it fuses, with intumescence and effervescence, readily into a dark scoria, which, in stronger heat, is converted into a shining black enamel. No water. With borax fuses into a glass coloured by iron while warm.

Epidote, manganesian (Th. 366; Al. 151).—From Aosta, Piedmont. Hardness about = 5·5. Scratched by a knife, streak reddish pink. In the forceps it intumesces much, effervesces, and fuses readily into a

brilliant dark purple bead. No water. With borax it effervesces, and dissolves speedily into a glass of a deep violet colour.

Epistilbite (Al. 127).—Faroe. Hardness about = 4·0. In the forceps it intumesces and curls up a little, and fuses readily into a white blebby globule, rendered perfectly transparent in a long-continued heat. Contains much water. With borax fuses readily into a colourless glass; gelatinizes slightly in cold nitric acid.

Erinite (Th. 341).—Antrim. Yields to the nail; streak white; feels soapy. In the forceps becomes white, and fuses with slight effervescence into a white blebby glass, rendered more transparent in a strong heat. Contains much water. With borax it effervesces a little at first, and fuses rather slowly into a colourless glass; with nitrate of cobalt it fuses into a blue glass; with bi-phosphate of soda it dissolves slowly into a colourless glass, which becomes opaline when cold, and leaves a transparent skeleton of silica. Mr. Allen had given the name of Erinite to an Arseniate of copper, said to be from the county Limerick, previous to the publication of Dr. Thompson's Mineralogy.—Allan, p. 83.

Essonite (*Vide* **Garnet**). (Th. 265; Al. 201).—County Donegal. About as hard as quartz. In the forceps fuses quietly and rather readily into a transparent greenish globule, slightly blebby. No water. With borax dissolves slowly into a glass coloured by iron.

Fahlunite, massive (*Vide* **Bonsdorffite**). (Th. 284; Al. 101).—Eric Matts, Sweden. Yields easily to the knife; almost sectile; streak white. In the forceps becomes white, and fuses on the edge (intumesces and curls up a little) and surface into a white blebby glass. Contains some water. With borax fuses very slowly into a colourless glass.

Fluate of Lime, octohedral.—In the forceps decrepitates violently; reduced to powder, and moistened, it fuses readily into a white bead, which turns turmeric paper brown. Contains some water. With borax fuses rather readily into a clear glass, which becomes opaque by flaming, if a sufficient quantity of the assay be used; heated on platina foil with sulphuric acid, it corrodes glass placed over it. Some specimens, in the forceps, phosphoresce, and emit a *purple* light for an instant, decrepitating slightly.

Franklinite (Ph. 219).—New Jersey, North America. Yields to the knife. Powder reddish-brown. A minute fragment is taken up by the magnet. In the forceps it fuses on the edge with some difficulty, and is rendered more attractable by the magnet. No water. With borax it dissolves slowly, the glass is coloured by iron; by adding a little nitre, the purple colour of manganese becomes evident in the outer flame. I believe Franklinite contains much less of manganese than its analyses indicate.

[**Fuchsite.**—Tyrol. In the forceps, fusible on the edge with great difficulty. With borax dissolves very readily, with effervescence, leaving a permanent green colour in the bead (chrome). In microcosmic salt dissolves with equal facility, leaving a skeleton; and the bead is coloured green when hot, colourless when cold (iron).—Ed.]

Fuller's Earth (Th. 246; Al. 307).—Nutfield, Surrey. Adheres to the tongue. Yields to the nail, and receives a polish from it; immersed in water, it falls into a pulpy mass. In the forceps it becomes brown, intumesces slightly, effervesces, and fuses readily on the edges into a greenish enamel, and forms a greyish blebby bead with difficulty. Contains water. With borax dissolves rather slowly into a transparent glass coloured by iron while warm.

Gabronite (Th. 289).—Stavern, Norway. Translucent on the edge. Yields to the knife: hardness about = 5·5; streak white. In the forceps, when gently heated, it becomes white and opaque, and a thin fragment fuses into a white blebby globule, which becomes transparent, if intensely heated. Contains little water. With borax it effervesces a little at first, and fuses very slowly into a colourless glass.

[**Gadolinite**.—Sweden. In the forceps glows intensely, and turns whitish-grey, fusing on the edge with slight intumescence. Contains water. With borax dissolves readily, giving a transparent bead coloured with iron. With microcosmic salt dissolves very slowly, and gives a transparent bead.—Ed.]

[**Gadolinite**.—County Donegal. In the forceps fuses readily into a black bead, with intumescence and ebullition. Contains water. With borax dissolves readily, with effervescence at first, into a bead coloured by iron when hot, colourless when cold; with nitre added, behaves as before, but the bead is greyish when cold. In microcosmic salt, dissolves, leaving a siliceous skeleton; bead coloured by iron while hot, of pearl-grey colour when cold, and somewhat opaque when nitre is added.—Ed.]

Garnet.—Vesuvius. In the forceps it fuses, with slight effervescence, into a dark green glass. Contains no water. With borax it effervesces a little at first, and small fragments fuse very slowly into a colourless glass, indicating a little iron while warm.

Garnet (*Vide* **Allochroite, Colophonite, Cinnamon Stone, Essonite**).—Resists the knife; hardness nearly = 7·0. In the forceps it fuses readily into a very brilliant black magnetic globule; in the inner flame it intumesces a little. No water. With borax fuses slowly into a glass deeply coloured by iron.

Garnet.—Resists the knife; hardness about = 7·5. In the forceps in a low heat becomes opaque, but regains its transparency on cooling; fuses quietly into a brilliant black globule, not magnetic. With borax fuses slowly into a glass coloured by iron.

Garnet, Pyrope or **Bohemian** (Th. 268; Al. 200).—It is not affected by the file. In the forceps, in a low heat, it becomes opaque, and regains its colour and transparency when cold; in the inner flame it effervesces, and fuses on the surface into a dark green glass, and scarcely forms a bead. Contains no water. With borax it fuses very slowly into a clear glass, indicating iron while warm, but becomes a bright chrome green when cold. [Fuses on the edge with difficulty. With borax fuses with difficulty into a bead coloured permanently green, indicating the presence of chrome.—Ed.]

Garnet, yellow manganesian.—Franklin Furnace, Sussex, New Jersey. Resists the knife. In the forceps fuses readily into a shining black globule. No water. With borax dissolves slowly into a glass coloured by iron; when nitre is added, and again heated, the glass becomes deep purple.

Gehlenite (Th. 281; Al. 161).—From Mount Monzoni in the Valley of Fassa, in the Tyrol. Scarcely yields to the knife; streak white. In the forceps fuses rather slowly on the edge, with some ebullition, into a muddy green glass, a very small fragment fuses into a bead. Contains a little water. With borax fuses slowly into a colourless glass, indicating a little iron while warm; with biphosphate of soda fuses slowly into a clear glass, which becomes opaline when cold, and leaves a skeleton of silica undissolved. This specimen does not gelatinize when reduced to powder, and moistened with nitric acid. Thompson asserts it does.

Gibbsite (*Vide* **Alumina, hydrated**).

Giesockite (Th. 382; Al. 100).—Akulliarasiarksuk, Greenland. Yields readily to the knife; streak white. In the forceps whitens; and in a good blast fuses on the edge into a white enamel. With borax it effervesces a little at first, and fuses very slowly into a colourless glass, indicating iron while it is warm. Rare.

Gilbertite (Th. 235).—Cornwall. Yields easily to the knife; sectile. In the forceps fuses slowly on the edge into a white enamel. Trace of water. With borax emits a few bubbles, and fuses slowly into a colourless glass; with acetate of cobalt, a deep blue.

Gmelinite (*Vide* **Hydrolite**). (Th. 340; Al. 119).—Island Magee, county Antrim. Yields rather easily to the knife; hardness 4·5; streak white. In the forceps partly falls to powder, then fuses quietly but slowly into a white blebby glass, semi-transparent when intensely heated. Contains much water. With borax fuses readily, leaving a skeleton which dissolves slowly; does not gelatinize with nitric acid.

Grenatite (Th. 279; Al. 202).—Manetsok, North Greenland. Scarcely yields to the knife. In the forceps it is infusible, but in a thin fragment blackens, and glazes a little in a good blast. Not magnetic after roasting. With borax effervesces a little, and is scarcely soluble.

[**Grenatite.**—Fuses with extreme difficulty, on the edge, turning black; and with borax, dissolves very slowly, with slight effervescence at first.—Ed.]

Halloysite (Th. 239; Al. 73)—Angleur, near Liege, France. Adheres to the tongue. Yields to the nail, and receives a polish from it; brittle. In the forceps it becomes first brown, then white; and is almost infusible; a thin edge glazes in a good blast. Contains much water. With borax it is nearly insoluble. Heated with nitrate of cobalt, it becomes blue on the edge.

Harmotome.—Strontian, Argyleshire. Yields rather easily to the knife. In the forceps, when roasted, it becomes white and opaque, and very

brittle, and fuses quietly into an opaline globule. Contains much water. With borax it breaks up, and dissolves very slowly into a colourless glass.

Harmotome (Th. 349; Al. 116).—Luganure, county Wicklow. It requires a stronger heat to fuse it than the specimens from other localities; characters similar in other respects.

Harmotome (Th. 349; Al. 116).—North of Ireland. Hardness about = 4·0. In the forceps becomes white and opaque, and fuses quietly into a milky globule, slightly blebby, and not rendered more transparent in a strong heat. Contains much water. With borax dissolves very slowly into a colourless glass.

Harmotome (Th. 349; Al. 116).—St. Andreasberg, Hartz Mountains. Yields to the knife with some difficulty. In the forceps becomes white, and fuses rather slowly into a white bead, rather opaque, and not blebby. Contains much water. With borax dissolves very slowly into a clear glass.

[Many specimens of Harmotome, in the forceps, decrepitate and become opaque, afterwards glow brilliantly, and then fuse, indicating soda by the flame.—Ed.]

Haüyne.—Vesuvius. Does not yield to the knife. In the forceps, in a good blast, fuses on the edge, with very slight effervescence, into a colourless blebby glass. With borax effervesces and fuses in large quantity, into a colourless glass.

Helvine (Th. 522.)—Saxony. Hardness = 6·0; streak white. In the forceps fuses with effervescence into an opaque yellow globule. With borax indicates manganese in the oxidating flame. No water.

Hematite, fibrous brown (*Vide* **Iron, hydrous oxide of**). (Ph. 221).—Glandore, County Cork. Hardness = 5; streak bright yellowish-brown. In the forceps blackens and becomes magnetic, and fuses on the edge. Contains water.

Hematite, fibrous red (Ph. 218).—Restormal Mine, Lostwithiel, Cornwall. Not attracted by the magnet. Yields with some difficulty to the knife. Hardness 5·5; streak dark red. In forceps decrepitates at first, and fuses into a grey magnetic scoria. It contains some water.

Heulandite (Th. 346; Al. 126).—Osteröe, Faröe Isles. Hardness about = 3·5. In the forceps becomes white; intumesces much; curls up; fuses into a white blebby bead. Contains much water. With borax it fuses rapidly into a colourless glass. The white rough grains are infusible alone, and very slowly soluble with borax. Reduced to a fine powder, it does not gelatinize when moistened with nitric acid.

Hisingerite.—Bodenmais, Bavaria. Yields to the knife; streak brownish. In the forceps it fuses on the edge, and becomes magnetic. Contains much water. With borax fuses speedily into a glass coloured by iron. No trace of manganese.

Hornblende (*Vide* **Actinolite**; **Amphibole**; **Anthophyllite**; **Asbestus**; **Mountain Cork**; **Smaragdite**; **Tremolite**).—Norway. Yields to the

knife. In the forceps fuses readily, and with scarcely any effervescence, into a black globule [or black scoriaceous mass—ED.] No water. With borax emits a few bubbles, and dissolves slowly.

Hornblende, ferruginous (Th. 198; Al. 145).—Hardness = 4·5; streak greenish. In the forceps intumesces and effervesces a good deal, and fuses very speedily into a black globule, feebly magnetic. No water. With borax dissolves speedily into a glass deeply coloured by iron. No manganese.

Hydrolite (*Vide* **Gmelinite**). (Th. 340; Al. 119).—North of Ireland. Hardness about = 4·0. In the forceps becomes white, and falls to powder; if very slowly heated, it fuses into a blebby white globule. Contains much water. With borax effervesces a little at first, and fuses readily into a colourless glass, leaving a small residue, which is more slowly soluble.

Hypersthene (*Vide* **Pyroxene**). (Th. 201; Al. 106).—Hardness about = 4·5. Superficial streak brown, deep streak greenish-grey. In the forceps a small portion fuses into a dark green bead; a large piece fuses only on the edge. Contains a trace of water. With borax fuses rather readily into a clear glass, coloured by iron. No manganese. It is rarely found crystallized.

Hypersthene.—Hardness about = 5·0; streak white. In the forceps in the inner flame fuses on the edge, with some ebullition, into a dark glaze. No water. With borax fuses very slowly into a glass coloured by iron.

Idocrase (*Vide* **Egeran**; **Cyprine**). (Th. 259; Al. 198).—Yields to the knife; streak white. Hardness about = 5·5. In the forceps it fuses readily, with intumescence and effervescence, into a brilliant dark-coloured globule, which in the outer flame becomes nearly transparent; and its opacity is restored in the reducing flame. With borax it effervesces a little, and fuses speedily into a glass coloured by iron.

Idocrase.—Norway. Resists the knife. In the forceps intumesces and effervesces much, and fuses readily into a dark, olive-coloured brilliant globule; not rendered more transparent by flaming. No water. With borax it breaks up, and fuses speedily into a clear glass, coloured by iron, which gives a trace of manganese on the addition of nitrate of potash.

Iolite (*Vide* **Dichroite**; **Pyrargillite**).

Iron, Arseniate of.—Cornwall. Yields very readily to the knife; streak nearly white. On charcoal it fuses readily, with intumescence, into a dark globule, attracted by the magnet; it emits some smell of arsenic. Contains water. Dissolves readily with borax.

Iron, carbonate of (*Vide* **Sphærosiderite**).—Cornwall. Yields easily to the knife; streak white. Does not effervesce with cold acids. In the forceps, by a gentle heat, it assumes a shining black colour, and becomes magnetic; in the inner flame it fuses on the edge. No water. With borax it emits bubbles at first, and dissolves readily into a glass deeply coloured by iron.

Iron, crystallized Oligiste (Th. 434.)—Isle of Elba. Yields with some difficulty to the knife. Hardness = 5·5; streak red. Feebly attracted by the magnet. In the forceps fuses with difficulty on the edge, [throwing out brilliant scintillations, if the experimenter understand the use of his blowpipe—Ed.] and becomes strongly magnetic. With borax it dissolves slowly into an olive-yellow glass.

Iron Earth, blue, (subsesquiphosphate of Iron).—Cornwall. Yields to the nail; streak blue. It fuses readily into a metallic-looking globule; magnetic when well roasted. Contains much water. With borax it fuses speedily into a glass coloured by iron.

Iron, hydrous oxide of (*Vide* Hematite, brown). (Th. 320).—Restormal Mine, near Lostwithiel, Cornwall. Not magnetic. Brittle; hardness = 5·0; streak yellowish-brown. In the forceps fuses on the edge without difficulty, and in a strong heat scintillates; it becomes strongly magnetic. Contains water.

Iron, magnetic oxide, fasciculated columnar.—Bohemia, or Franconia. Before roasting, and in a good heat, fuses into a black magnetic scoria. Contains water. It is very remarkable for its magnetic property.

Iron, massive phosphate of.—North America. Streak bluish. In the forceps it decrepitates; but if slowly heated, it fuses readily into a black globule. This appears to be the Mullicite of Thomson, p. 452.

Iron Ore, bog (Ph. 222).—North of Ireland. Hardness about = 3·5. Powder yellowish-brown. In the forceps blackens, fuses readily on the edge, and becomes magnetic. Contains much water.

Iron ore, Lamellar Specular.—Arinahincha, county Cork. Not magnetic. Yields to the knife. Powder dark red; very thin laminæ transmit a blue-red light, when viewed with a lens. In the forceps it fuses on the edge, and becomes magnetic.

Iron, oxydulated, (Magnetic Oxide).—Haytor Mine, Dartmoor, Devonshire. Brittle; hardness = 5·5; powder black. Attracted by the magnet, but does not attract iron filings. In the forceps, in a strong heat, it fuses on the edge, into a steel-grey mass, but a small fragment forms a bead with great difficulty. With borax fuses rather readily into a glass deeply coloured by iron.

Iron, phosphate of (Vivianite), (Th. 455).—Dobschau, Hungary. Yields very easily to the knife; hardness = 1·5; streak blue. In the forceps it fuses very readily into a greenish-black globule, with a metallic lustre, which becomes magnetic when well roasted. Contains much water. With borax it fuses speedily into a glass coloured by iron. It contains no manganese.

Iron Pyrites, magnetic (Ph. 213).—Hardness about = 4·5. Powder greyish-black. On charcoal it emits the smell of sulphurous acid, and fuses readily into a globule, brilliant while hot, greyish-black and rough when cold. It is attracted by the magnet, both before and after roasting.

Iron, radiated carbonate of.—Kannioak, Greenland. Hardness = 4; streak white. Does not effervesce with cold muriatic acid; dissolves with effervescence in warm acid. In the forceps it blackens, and be-

comes magnetic; in a strong heat it fuses on the edge into a black glaze. Contains water. With borax effervesces, and dissolves readily into a glass coloured by iron. No trace of manganese. This mineral is generally supposed to be brown wavellite, and is sold in London at a very high price.

Iron, Titaniferous (Ph. 216).—Auvergne. Translucent on the edge. Hardness=5·0–5·5; streak greyish. Infusible. With borax slowly soluble into a glass coloured by iron; with salt of phosphorus, dissolves slowly into a glass coloured by iron while warm; reddish amethyst colour when cold.

Iron, Tungstate of (Wolfram), (Ph. 236).—Zinnwald, Bohemia. Hardness = 4·5; streak reddish-brown. In the forceps it fuses rather readily into a black scoriaceous bead not attracted by the magnet. No water. With borax, dissolves readily, in the outer flame, into a glass, reddish-purple when cold; in the inner flame it is greenish while warm, and nearly colourless when cold.

Isopyre (Th. 377; Al. 190).—From Huel Bassett, Cornwall. Not so hard as quartz; powder greenish-white; thin fragments are translucent, with an olive colour. In the forceps it is infusible, but loses its colour and becomes greyish-white. Contains a good deal of water. With borax dissolves very slowly into a glass, coloured by iron while warm; with biphosphate of soda partially fuses, and becomes slightly opaline when cold, if saturated.

[**Jelletite**.—Saas Thal, Switzerland. Hardness = 7; sp. gr. = 3·741. In the forceps turns black, and fuses, with difficulty, on the edge. No water. With borax, fuses into a bead coloured with much iron. With microcosmic salt dissolves slowly, leaving no skeleton. This is a variety of Garnet.—Ed.]

Johannite (sulphate of Uranium) (Ph. 271).—Joachimsthal, Bohemia. Sectile; powder very pale green. In the forceps, at a low heat, it becomes orange-coloured; is reduced in size (probably owing to the vaporization of the water), and is infusible. Contains much water. With borax it effervesces, and dissolves readily into a glass of a yellow colour, not discharged on adding nitre. Dissolves readily in nitric acid, with effervescence; at least, the yellow pulverulent coating behaves thus with nitric acid. Extremely rare.

Karpholite (Th. 325; Al. 161).—Schlackenwald, Bohemia. Hardness about = 5·0; streak white. In the forceps becomes white, and fuses rather readily, with ebullition, into a yellowish bead. Trace of moisture. With borax, in outer flame fuses rather readily, with slight effervescence at first, into an amethyst-coloured glass.

Karpholite (Th. 325; Al. 161).—Schlackenwald, Bohemia. Hardness about= 4; streak white. In the forceps the fibres diverge, and fume with slight intumescence and effervescence into a pale brown scoria, which, in a good heat, forms a bead of the same colour. No water. With borax dissolves readily into a glass, coloured by manganese in the outer flame; in the inner flame it becomes colourless.

Killinite (Th. 330; Al. 102).—Killiney Quarry, near Dublin. Yields easily to the knife; streak white. In the forceps, at a low heat, it blackens, then intumesces a little, and fuses on the surface into a rough white enamel; a minute splinter fuses into a shining white globule. Contains some water. With borax effervesces at first, indicates some iron, and fuses very slowly into a colourless glass.

[In the forceps intumesces, and melts into a glassy bead, more readily than Spodumene; flame indicates slight trace of Lithia; and, in melting, the assay glows brilliantly.—Ed.]

Kirwanite (Th. 378).—Mourne Mountains, county of Down. Yields easily to the knife; streak nearly white. Effervesces with muriatic acid, very briskly if reduced to powder. In the forceps it intumesces, and effervesces a little at first, and fuses readily into a shining black globule, very feebly magnetic. Contains a little water. With borax it effervesces a little at first, and fuses rather quickly into a glass deeply coloured by iron. No trace of manganese.

Kyanite (*Vide* **Bucholzite; Rhætizite**).

Kyanite (Th. 241; Al. 108).—St. Gothard. Yields easily to the knife on the broad plane of the prism, while the edge of the crystal resists the file; streak white. In the forceps it is infusible; and when intensely heated, it loses its colour, and becomes white. Contains no water. With borax it is almost infusible. With nitrate of cobalt it becomes blue.

Kyanite (Th. 241; Al. 108).—Shetland Isles. Hardness about = 4·0. In the forceps infusible. No water. With borax scarcely soluble.

Labradorite (Th. 297; Al. 139).—Gweebarra River, Donegal. In the forceps fuses on the edge into a clear glass; in a good heat a small fragment forms a bead. With borax it is very slowly soluble. No water.

Laumonite (Th. 332; Al. 120).—Maggia, St. Gothard. Hardness about = 4·0. In the forceps, at a low heat, it blackens for an instant, then fuses quietly but slowly into a rough blebby colourless glass, and scarcely forms a bead. Contains a good deal of water. With borax it is very slowly soluble. Does not gelatinize in nitric acid.

Lazulite (*Vide* **Bluespar**).—(Th. 310; Al. 157).—Vorau, Styria. Yields to the knife; streak pale blue. In the forceps loses its colour, and fuses on the edge into a white enamel. With borax fuses into a glass coloured by iron.

Lead, arseniate of (Ph. 364).—Johanngeorgenstadt, Saxony. Hardness = 3·5; streak white. On charcoal it decrepitates a little; fuses readily; emits the smell of arsenic, and nothing remains but globules of metallic lead.

Lead, arsenio-phosphate of (Ph. 362).—Cumberland. Hardness = 3·5; streak white. On charcoal it fuses quietly, with some ebullition, into a globule, which on cooling becomes white, and crystallizes into polygonal facets, emits a faint smell of arsenic, and yields some globules of lead.

Lead, arsenio-phosphate of.—West Fell, Cumberland. Of a wax-yellow colour. Hardness = 3·0; streak yellow. On charcoal decrepitates; but if slowly heated, it melts, and emits a faint smell of arsenic; metallic globules of lead are formed, and enveloped in a glassy residue, which forms a globule with difficulty; it crystallizes on cooling. Rare. The dark-coloured crystalline globule, when fused with borax, forms a colourless glass, which becomes green when cold: this is, probably, owing to a minute portion of chrome.

Lead, fasciculated brown arseniate of.—Cornwall. Hardness = 3·5; streak white. On charcoal it fuses readily, and emits faint odour of arsenic, and nothing remains on the charcoal but grains of lead.

Lead, chromate of (Ph. 368; Th. 560).—Beresoff Mine, Siberia. Hardness = 2·5; streak and powder orange-yellow. On charcoal it decrepitates violently; reduced to powder, and moistened, it becomes black, and fuses readily into a black fluid mass; deposits minute globules of lead round the assay, and leaves a black scoria, infusible, and not magnetic. With borax fuses into a deep green glass, opaque unless a very minute portion of the assay be used.

Lead, molybdate of, crystallized (Th. 562).—Bleiberg, Carinthia. Hardness = 3·0; streak white. Decrepitates violently on charcoal; it fuses, when reduced to powder and moistened, into a yellow mass, and globules of lead are formed. With salt of phosphorus a small portion of assay fuses readily into a glass of a fine green colour.

Lead, muriate of (Ph. 360; Th. 557).—Churchill, in the Mendip Hills, Somersetshire. Hardness = 2·5; streak white. On charcoal it decrepitates; reduced to powder and moistened, it is speedily reduced to metallic lead on charcoal, and exhales white fumes; heated with biphosphate of soda, and peroxide of copper, the flame assumes a fine blue colour for an instant. Extremely rare.

Lead, phosphate of (Ph. 362).—Luganure, county Wicklow. Hardness = 3·5; streak white. On charcoal fuses readily, with slight ebullition, into a globule, yellow while warm, pearly white and crystallized when cold; with carbonate of soda it yields globules of lead.

Lead, phosphate of.—From Drigeth, West Fell, Cumberland. Soluble in warm nitric acid, without effervescence. Character same as last.

Lead, green phosphate of.—Luganure, county Wicklow. On charcoal it decrepitates; but if slowly heated, it fuses with some ebullition into a globule, which crystallizes in large facets when cold; but if the fusion is prolonged, it retains its globular form even when cold.

Lead, brown phosphate of.—Przibram, Bohemia. Hardness = 3·5; streak white. On charcoal fuses readily and quietly into a globule, which crystallizes in broad facets when cold; at the moment it crystallizes, a gleam of light is emitted by the globule; it does not contain arsenic; with carbonate of soda it gives globules of lead.

Lead, brown phosphate of.—Huelgoet, Lower Brittany. Hardness = 3·0; streak white. On charcoal minute particles fly off with slight decrepitation; fuses readily into a bead, which is white and crystal-

lized on its surface when cold. No water. With borax effervesces a little, and dissolves rapidly into a glass, transparent and yellow while warm, colourless when cold. Becomes opaque by flaming. With carbonate of soda it is speedily reduced.

Lead, sulphato-carbonate of (Ph. 358; Th. 567).—Lead Hills, Cumberland. Hardness = 2·5. Does not effervesce in acid; it is partly dissolved. On charcoal does not decrepitate, and fuses readily into a brown mass, and yields globules of lead.

Lead, sulphate of (Ph. 365; Th. 559).—Paris Mine, Isle of Anglesea. Hardness = 3·0. On charcoal, in the outer flame, fuses quietly and readily into a globule, which is white when cold, and in the reducing flame it speedily yields globules of lead.

Lead, sulphate of.—Luganure Mine, county Wicklow. It decrepitates strongly when heated; in other respects it is similar to the last. Extremely rare in this locality.

Lead, sulphuret of.—Hero Shaft, Luganure, county Wicklow. Yields easily to the knife. On charcoal it fuses quietly, and becomes very fluid; in the reducing flame it yields grains of lead, and deposits a yellow powder on the charcoal; does not emit smell of sulphur while fusing.

Lead, Tungstate of (Ph. 370).—Zinnwald, Bohemia. Hardness = 3·0; streak white. On charcoal it fuses readily into a dark-coloured globule. No water. With borax dissolves readily into a glass, which becomes opaque and white when cold, if a large portion of the assay be used.

Lead, vanadiate of (Ph. 370; Th. 573).—Wanlock Head, Lead Hills, Cumberland. The crystals are aggregated in small globules. Hardness = 3·0; streak white. On charcoal it fuses readily, with ebullition, and is partly reduced to metallic globules, and a black scoriaceous mass remains. No water. With borax it dissolves readily, and on cooling becomes opaque; and blue (by reflected light only), if the proportion of the assay be large; but if a small portion be used, the bead is emerald green.

Lead, vanadiate of, compact mamillated.—Wanlock Head, Lead Hills, Cumberland. Hardness = 3·5–4·0. Its pyrognostic characters are the same as the last.

Lehuntite (Th. 338).—Glenarm, county Antrim. Yields to the knife; hardness about = 4·0. In the forceps fuses quietly into a blebby colourless bead. Contains water. With borax it fuses rather slowly into a colourless glass. Gelatinizes feebly in nitric acid.

Lepidokrokite.—Pfortzheim, Baden. Yields easily to the knife; streak yellowish-brown. In the forceps fuses into a grey metallic-looking magnetic globule. With borax it fuses speedily into a glass deeply coloured by iron. Contains water. Nitre does not indicate manganese.

Lepidolite (Th. 361; Al. 93).—Rozena, Moravia. Yields easily to the knife; streak white. In the forceps fuses very readily, with intumescence and effervescence, into a white vesicular globule, which becomes transparent and colourless, if heated intensely for a short

time. With borax, it fuses speedily with effervescence, and in large quantity, into a colourless glass. [The borax bead, held in the oxydating flame, acquires an amethystine colour, indicating the presence of manganese—ED.] I could not detect boracic acid by the blowpipe with Dr. Turner's flux of bisulphate of potash, and fluate of lime. While fusing, it tinges the flame behind the assay carmine-red, particularly if the jet be passed near the assay and does not envelope it; if the assay be fused with powdered fluor spar, the red colour is readily perceived. Heated with sulphuric acid on platina foil, and a piece of glass placed over it, it gives a trace of fluoric acid.

Leucite (Th. 286; Al. 112).—Yields to the knife. In the forceps emits a brilliant light, and in good blast fuses on the edge into a clear glass. With borax dissolves very slowly into a clear glass.

Levyne (Th. 335; Al. 118).—Benevenagh, county Derry. Yields to the knife. In the forceps becomes white, intumesces much, and fuses into a white blebby globule. Contains much water. With borax dissolves speedily into a transparent glass, with slight effervescence. Does not gelatinize with nitric acid.

Lievrite (Th. 148; Al. 230).—Rio la Marina, Island of Elba. Hardness about = 5·5; powder blackish-green. Not magnetic before roasting. In the forceps it becomes magnetic when gently heated, and fuses readily, with slight effervescence, into a black magnetic bead. With borax effervesces for an instant and fuses rather slowly into a transparent glass deeply coloured by iron. Does not contain manganese.

Lime, bisesquihydrous arseniate of, (Pharmacolite) (Th. 135; Al. 21).—Princess Sophia Mine, near Wittichen, Baden. On charcoal it gives out a faint arsenical odour. In the forceps it fuses readily, with some effervescence and intumescence, into a bluish globule, opaque. Contains much water. With borax fuses readily into a pale cobalt-blue glass.

Lime, phosphate of (*Vide* **Apatite**).—Arendal. Hardness about = 4·5; streak white. In the forceps fuses slowly on the edge into a white glaze. No water. With borax it dissolves very slowly, and becomes opaque by flaming; it is entirely soluble in biphosphate of soda.

Lime, Tungstate of (Ph. 182).—Bohemia. Hardness = 4·0; streak white. In the forceps it becomes white, then grey, and fuses on the edge, with difficulty, into a dark grey glaze. No water. With borax dissolves, rather readily in the inner flame, into a glass bluish-grey when cold, and it becomes white by flaming.

Lime, Tungstate of, amorphous.—Schoenfield, Bohemia. Hardness = 4·0. Decrepitates a little; acts with fluxes like the preceding, except that it does not become grey in the reducing flame.

Lithomarge (Th. 374).—Adheres to the tongue. Yields to the nail, and receives a polish from it. In the forceps whitens, and is infusible. Contains much water. Nearly infusible with borax. With cobalt becomes blue.

Magnesia, carbonate of (Th. 157; Al. 39).—Down Hill, Derry. Hardness nearly = 5·0. With muriatic acid it effervesces briskly. In the forceps is infusible. No water. With borax it effervesces much, and dissolves readily and in large quantity into a glass, which becomes opaque by flaming, if it be saturated.

Magnesia, carbonate of (Th. 157; Al. 39).—Hoboken, New Jersey. Hardness = 4·5. Does not effervesce, unless reduced to powder. Infusible. No water. With borax effervesces briskly, and dissolves rapidly.

Magnesia, hydrate of (Th. 156; Al. 95).—Swinaness-Unst, one of the Shetland Isles. Soft, yields to the nail. Is entirely soluble in nitric acid, without effervescence. In the forceps it becomes white and opaque, but retains its pearly lustre, and is infusible. When roasted, it tinges turmeric paper brown. With acetate of cobalt becomes pale pink. Contains water. With borax fuses readily into a clear glass, which, if saturated, is opaque when cold.

Magnesia, hydro-carbonate of (Th. 159).—Hoboken, New Jersey. Structure fibrous, radiated, soft. Effervesces briskly with muriatic acid. In the forceps the fibres diverge and curl up much, but it is infusible. Contains a good deal of water. With borax dissolves readily, with slight effervescence.

Manganese, bisilicate of (Th. 516).—Ural Mountains, Siberia. Hardness = 5·7; streak white. In the forceps it fuses readily, with slight effervescence, on the edge, into a brown glass, and forms a bead with difficulty. No water. With borax it emits some bubbles, and fuses slowly into a glass of an amethyst colour in the oxydating flame.

Manganese, black oxide of.—Harz. Hardness = 4·0; powder black. Contains a good deal of water. Decrepitates a little when heated, and is infusible.

Manganese, lenticular carbonate of.—Schneeberg, Saxony. Hardness = 3·5. When scraped, it effervesces briskly with acid. In the forceps it decrepitates violently; reduced to powder, and moistened, it blackens, and is infusible. No water. With borax it effervesces briskly, and dissolves readily into a glass of a deep reddish colour.

Manganese, hydrated oxide of.—Glandore, county Cork. Hardness = 5·5–6·0. Powder brownish-black. In the forceps glazes on the edge, and is feebly attracted by the magnet. Contains a large portion of water.

Manganese, mamillated oxide of.—Restormal Mine, Lostwithiel, Cornwall. Hardness = 4·0. Powder black. Infusible. Contains some water.

Manganese, phosphate of, and Iron (Th. 472).—Near Limoges, France. Hardness = 5·0; streak greyish-white. In the forceps it decrepitates; but if gradually heated, it fuses readily, with slight intumescence, into a black bead, attracted by the magnet. A trace of water. With borax it dissolves readily. In the outer flame it indicates manganese, and in the reducing flame iron.

Manganese, sesquisilicate of (Th. 514). Franklin, New Jersey, North America. Colour nearly black. Hardness = 5·5; streak dark red. In

the forceps glazes on the edge, but does not fuse; it is attracted by the magnet after roasting. No water. Dissolves in borax; and it is difficult to exhibit the colour of the manganese in the outer flame.

Manganese, slaty oxide of.—Roury, county Cork. Hardness = 4·0. Powder black. Fuses on the edge into a black glass. Contains some water.

Manganese, sulphuret of.—Nagyag, Transylvania. Colour dark brown. Hardness = 4·0; streak greenish. Effervesces with muriatic acid, and gives out a smell of sulphuretted hydrogen. On charcoal it fuses quietly, but slowly, into a black scoriaceous bead, not attracted by the magnet. No water. With borax it is very slowly soluble, and the amethyst colour does not appear until the assay is entirely dissolved.

The grey portion.—Hardness = 2·5; streak grey. In the forceps it becomes black, and glazes on the edge, but does not fuse. Effervesces with muriatic acid, and emits a smell of sulphuretted hydrogen. With borax it dissolves very slowly, and the moment the assay is entirely dissolved, the amethyst colour is developed.

There appear to be two distinct combinations of sulphur and manganese in this specimen. Compare the analyses of Vauquelin, and Arfvedson in Allan's Manual of Mineralogy, page 279.

Manganite, crystallized (Th. 502).—From Lahn, on the Rhine. Hardness = 3·5. Powder greyish-black; infusible. Contains a little water. With borax gives an amethyst coloured glass.

Manganite, prismatic.—Hardness = 4·0; powder brown. Decrepitates; infusible. Contains some water.

Marmatite (sulphuret of Zinc and Iron) (Th. 548). Hardness = 4·5; streak pale yellowish-brown. In the forceps it does not decrepitate; it is more fusible than the common brown blende; it scarcely forms a bead, which is feebly attracted by the magnet. No water. With borax dissolves slowly into a glass, transparent while hot; muddy, opaque, and dark-coloured when cold.

Meionite (Th. 271; Al. 139).—Monte Somma, Vesuvius. Effervesces with muriatic acid. In the forceps intumesces and effervesces to a great degree, and fuses slowly into a blebby colourless glass. With borax fuses rather slowly, with *continued* effervescence. This specimen does not gelatinize with nitric acid. The effervescence is caused by a superficial coating of carbonate of lime on the crystals. The transparent part of the crystals does not effervesce. Yields with difficulty to the knife.

Mellilite (Th. 207; All. 207).—Capo de Bove, near Rome. Yields to the knife; hardness about = 4·5; streak white. In the forceps fuses readily into a transparent green glass bead. No water. With borax it dissolves slowly into a glass coloured by iron.

Menilite.—Menilmontant, near Paris. Hardness about = 7·0. In the forceps infusible, but becomes white and opaque. Contains water. With borax fuses slowly into a colourless glass.

Mesole.—Yields easily to the knife; scratched by fluor spar. In the forceps fuses readily, with some intumescence and effervescence, into a bead, transparent while hot, but white and opaque when cold. Contains much water. With borax effervesces a little at first, and fuses slowly into a glass, colourless and transparent; with nitrate of cobalt, it fuses into a blue glass. Reduced to powder, and moistened with nitric acid, it gelatinizes slightly. It is very tough.

Mesole (Al. 128).—Faroe Isles. Hardness about = 3·5. Its pyrognostic characters correspond exactly with those of Mesolite.

Mesole (Al. 128.)—Portrush, North of Ireland. Hardness about = 4·0. In the forceps becomes white; exfoliates a little; intumesces and fuses rather slowly into a white blebby bead. Contains much water. With borax it dissolves readily. When reduced to powder, and moistened with nitric acid, it gelatinizes.

Mesolite (Th. 317; Al. 122).—Yields with some difficulty to the knife. In the forceps it becomes opaque, exfoliates, intumesces, and fuses into a white blebby globule, which becomes more transparent in a stronger heat. Contains much water. With borax it effervesces a little at first, and then fuses readily into a transparent colourless glass, leaving a skeleton which is more slowly soluble. When powdered, it gelatinizes with nitric acid. This is the Skolezite of Mr. Allan.

[**Mica, Margarodite.**—Three-rock Mountain, county Dublin. Fusible on the edge with great difficulty. Contains water. With borax dissolves readily. Leaves a skeleton of silica in microcosmic salt, in which, however, it easily dissolves.—Ed.]

Molybdena, sulphuret of (Th. 88).—Cumberland. Yields to the nail. In the forceps it is infusible, and does not undergo any change with borax.

Mussite (*Vide* **Pyroxene**). (Th. 187; Al. 144).—Mussa, Piedmont. Hardness = 5·0. In the forceps, in the outer flame, fuses quietly into a clear glass; in the inner flame intumesces and effervesces. A piece the size of a pin's head fuses only on the edge. With borax fuses very slowly. Contains no water.

Nacrite (Th. 244).—Fair Mountain, Glendalough, county Wicklow. Yields easily to the knife; streak white. In the forceps fuses on the edge with difficulty, into a white enamel. Gives a trace of water. With borax it effervesces at first, and fuses slowly into a transparent glass, coloured by iron while warm. With biphosphate of soda partly fuses into a glass, which is slightly opaline when cold, if saturated, and leaves a large residue of silex.

Napoleonite (Th. 291). Corsica. Yields with difficulty to the knife; powder white. In the forceps becomes white, and fuses on the edge into a blebby glass. Does not contain water. Almost insoluble with borax.

Natrolite (Th. 315; Al. 121)—North of Ireland. Yields to the knife; hardness about = 5. In the forceps, at a low heat, it becomes opaque,

and fuses readily and quietly into a clear colourless globule; in a stronger heat it blisters on the surface. Contains water. With borax it fuses rather readily into a colourless glass. Reduced to powder, and moistened with nitric acid, it gelatinizes.

Natrolite, crystallized (Th. 315; Al. 121).—Hohentwiel, Suabia. Yields to the knife; hardness about = 5·0. The crystals fuse readily into a transparent colourless globule. The brown fibrous portion, when gently heated in the forceps, becomes red, and fuses readily into a blebby colourless bead, which becomes transparent in a good blast. Contains water. With borax fuses slowly into a colourless glass. Gelatinizes with nitric acid.

Needle Ore of Bismuth (Ph. 278; Th. 596).—Beresoff, Siberia. Yields readily to the knife; powder lead-grey. On charcoal fuses readily; emits some sulphurous fumes; is partly volatilized; deposits minute globules of lead around the assay; and after intense roasting a globule of pure copper remains. Extremely rare.

Nemalite (Th. 166; Al. 314).—From Hoboken, New Jersey. Does not effervesce in nitric acid, and is not entirely soluble in it. Infusible, but becomes pale brown. Contains water. Dissolves readily in borax into a glass slightly coloured by iron.

Nepheline, primitive (*Vide* **Elæolite**). (Th. 256; Al. 132). Vesuvius. Fuses into a colourless and transparent bead slowly in the forceps. Very slowly soluble in borax.

Nickel, copper-coloured.—Hardness = 5·5; brittle. On charcoal it soon gives arsenical fumes, and fuses rather slowly into a black bead, which is not magnetic. With borax the globule dissolves readily, and forms a blue glass. It alloys with the platina.

Nickel Ochre (Th. 528, and 524).—Cornwall. When heated on charcoal, becomes yellow; and, after long continued roasting, it fuses into a black scoria, which soon forms a globule, highly magnetic.

Nickel, sulphuret of (Th. 524).—Merthyr Tydvil, South Wales. On charcoal it fuses readily into a black globule, strongly attracted by the magnet. The fused globule dissolves readily in borax, and gives an amethyst-coloured glass; in a stronger heat the glass is violet-blue by transmitted light, and olive-green by reflected light.

Nuttalite (*Vide* **Scapolite**). (Th. 382; Al. 142).—Boston, Massachussets, North America. Yields to the knife with difficulty; streak white. In the forceps intumesces and effervesces much, and fuses slowly into a blebby colourless glass. Trace of moisture. With borax fuses rather quickly, with prolonged effervescence, into a transparent glass, faintly coloured by iron.

Obsidian (Th. 393; Al. 188).—Tokay, Hungary. Translucent on the edge. Resists the knife; hardness about = 6·5; powder greyish-white. In the forceps it becomes colourless, and fuses with difficulty on the edge into a slightly blebby, transparent, and colourless glass. Contains no water. With borax dissolves very slowly into a transparent colourless glass.

Olivine (Th. 163; Al. 192).—Otaheite. Resists the knife. In the forceps infusible. No water. With borax soon indicates iron, but fuses very slowly.

[**Olivine**.—Vesuvius. In the forceps fuses readily, with effervescence, into a black scoria. No water. With borax dissolves easily into a transparent bead, coloured by much iron. With microcosmic salt, dissolves readily, with continued effervescence, leaving a siliceous skeleton.—Ed.]

Orpiment (*Vide* **Arsenic, yellow sulphuret of**).

Paranthine (*Vide* **Scapolite**). (Th. 271; Al. 139).—Hardness = 4·5–5·0. In the forceps effervesces and intumesces, and fuses readily into a colourless blebby globule. No water. With borax dissolves readily, with prolonged effervescence, into a clear glass, slightly coloured by iron while warm.

Pearl spar.—Killiney Quarry, Dublin. Scratches calc spar. Effervesces feebly with nitric acid. In the forceps decrepitates slightly, becomes black, and fuses on the edge into a black glaze, not magnetic. No water. With borax effervesces much, and dissolves readily. Contains iron.

Pearl Spar.—Knockmahon, county Waterford. Scratches calc spar. Effervesces with muriatic acid when scraped. In the forceps decrepitates violently; infusible; effervesces strongly with borax.

Pearlstone (Th. 390; Al. 188).—Bochnitz, Hungary. Hardness = 5·0; brittle. In the forceps intumesces much, suddenly, and fuses very slowly into a rough, blebby, colourless glass. No water, or only a trace. With borax emits a few bubbles, and fuses rather readily into a clear glass.

Phillipsite (Th. 351 : Al. 117).—Island Magee, North of Ireland. In the forceps becomes white and opaque, falls partly to pieces, and fuses rather slowly into a transparent rough bead. Contains much water. With borax it becomes transparent, and fuses slowly into a colourless glass.

Pimelite.—From Silesia. Hardness = 2·0; streak white. In the forceps decrepitates at first, blackens, and fuses on the edge into a grey glass; it does not form a bead. Contains much water. With borax, in the outer flame, it dissolves slowly, and the glass is of a pale amethyst colour when cooling, but is nearly colourless when cold.

Pitchstone (Th. 392).—Johanngeorgenstadt, Saxony. Yields to the knife; streak white; hardness about = 5·5. In the forceps becomes white, and fuses on the edge into a blebby colourless glass. Contains a good deal of water. With borax it effervesces a little at first, and fuses rather slowly into a colourless glass.

Pitchstone (Th. 392).—Saxony. Resists the knife; hardness about = 6·5. In the forceps fuses readily into a brilliant dark green globule. No water. With borax it effervesces a little at first, and fuses slowly into a clear glass coloured by iron.

Pitchstone, slaty (Th. 392).—Newry. Yields with difficulty to the knife; streak white. In the forceps becomes white, and fuses on the edge into a blebby colourless glass. Contains some water. With borax fuses slowly, with slight effervescence, into a colourless glass.

Plasma.—Hard as quartz. Translucent on the edge. In the forceps becomes white, but is infusible. Contains a good deal of water. With borax, a small fragment dissolves slowly; with carbonate of soda effervesces briskly, and dissolves speedily.

Pleonaste (Black Spinel). (Th. 213; Al. 165).—Amity, New York, North America. Scratches quartz; brittle. Infusible alone. No water. With borax fuses with great difficulty.

Polymignite (Ph. 261).—Friedrichsvärn, Norway. Hardness = 5·5; streak pale brown. In the forceps infusible. With borax effervesces, and fuses rather easily into a glass coloured by iron.

Prehnite (*Vide* **Edelite**). (Th. 274; Al. 110).—Resists the knife; hardness about = 6·0. In the forceps whitens; the fibres diverge; it intumesces and effervesces much, and fuses readily into a pale green transparent globule, slightly blebby. No trace of water. With borax effervesces much at first, and fuses readily into a transparent glass coloured by iron while warm. Does not gelatinize with nitric acid.

Prehnite (Th. 274; Al. 110).—Scotland. Resists the knife. In the forceps it becomes white; intumesces and effervesces much, and fuses into a colourless blebby globule. No water. With borax it fuses, with effervescence, very quickly into a colourless glass, and dissolves in very large quantity. [In microcosmic salt, dissolves more slowly than in borax, with effervescence, into a colourless bead, leaving a siliceous skeleton.—Ed.]

Psilomelane.—Glenmalure Mine, county Wicklow. Hardness = 6·0. Decrepitates when heated; infusible.

Psilomelane, botryoidal (Th. 508).—Siegen, on the Rhine. Hardness = 6·0; powder nearly black. Infusible; not attracted by the magnet after roasting. Contains a little water.

Pyonite (*Vide* **Topaz**). (Th. 254; Al. 174).—Altenberg, in Saxony. Brittle; scratches quartz feebly. In the forceps it decrepitates a little, becomes white and opaque, and is infusible. Contains no water. With borax it fuses slowly into a colourless glass.

Pyrargyllite (*Vide* **Iolite**). (Th. 238; Al. 318).—Helsingfors, in Finland. Hardness about = 3·25; yields easily to the knife; streak white. Small fragments are translucent on the edge. In the forceps cracks a little, becomes white; in a good blast it glazes on the edge. Heated with nitrate of cobalt, it becomes pale blue. Contains a considerable portion of water. With borax dissolves very slowly into a transparent glass, feebly coloured by iron while warm. Very rare.

Pyrites, cockscomb (Ph. 212).—Derbyshire. Yields with difficulty to the knife; hardness about = 6; streak greyish-black. On charcoal it blackens; emits pungent fumes, and fuses readily into a globule, rough and magnetic when cold.

Pyrolusite, acicular.—Schurde, Thuringia. Hardness = 2·5; powder greyish-black. Infusible. A trace of water.

Pyrolusite, radiated.—Soft; soils paper like Plumbago; powder nearly black. Infusible. Does not contain water. With borax it dissolves readily, and tinges it of a deep amethyst colour.

Pyrolusite, compact mamillated.—Hardness = 2·5; powder black. Infusible. No water. With borax as before.

Pyrope (*Vide* **Garnet**).

Pyrophysalite (*Vide* **Topaz**). (Th. 253; Al. 174).—Finbo, near Fahlun, Sweden. Yields to the knife; streak white. In the forceps becomes white; and, in a good heat, fuses or rather glazes on the edge. Contains a little water. With borax effervesces a little at first and fuses very slowly; with acetate of cobalt, becomes blue.

Pyroxene (*Vide* **Augite; Bronzite; Coccolite; Hypersthene; Mussite; Sahlite**).—Fuses readily on the surface with very slight effervescence; but forms a bead with difficulty. With borax soon indicates iron, and dissolves very slowly. The black grains from the under side fuse readily, with effervescence and intumescence, and thereby prove that the other portion has been partially fused.

Realgar (*Vide* **Arsenic, red sulphuret of**).

Rhætizite (*Vide* **Kyanite**). (Th. 241; Al. 108).—Tyrol. Yields easily to the knife. In the forceps becomes white; is infusible; and, with nitrate of cobalt, becomes blue. Almost insoluble with borax. No water.

Rhodonite (*Vide* **Allagite; Bustamite**).

Rhomb Spar.—Cornwall. Scratches calc spar. Effervesces feebly with nitric acid when scraped; decrepitates violently; when heated slowly, it blackens; is infusible, and does not become magnetic. With borax it effervesces briskly, and dissolves readily.

Rutile (*Vide* **Anatase; Brookite; Titanium, golden-haired**). (Ph. 254).—Killin, Argyleshire. Hardness = 5·5; streak nearly white; brittle. In the forceps infusible; with borax it dissolves very slowly into a glass of a pale amethyst colour when cold; with a larger proportion of the assay it is almost black and opaque by reflected light, and dark amethyst colour by transmitted light; in the outer flame the colour is discharged; not made opaque by flaming. With salt of phosphorus it dissolves with the greatest difficulty, requiring a very prolonged and intense heat; the glass is yellow while warm, amethyst colour when cold;—the colour is not discharged by the outer flame.

Rutile (Ph. 254).—Brocca Mountain, Luganure Mines, county Wicklow. Hardness 5·0–5·5; streak yellowish-white. A thin fragment is translucent on the edge; transmits a red colour. In the forceps it is infusible; in an intense heat glazes a little on its surface. No water. With borax very slowly soluble; the glass is colourless while warm; pale amethyst colour while cold; not made opaque by flaming; in the outer flame the colour is discharged, and it remains colourless on cooling.

Sahlite. (*Vide* **Pyroxene**). (Th. 187; Al. 143).—Tiree Island, Scotland. Hardness = 5·0; streak white. In the forceps, in the outer flame, it fuses on the edge into a green glass, slightly blebby; in a strong heat it boils a good deal, and a small fragment forms a clear green bead with difficulty. Does not contain any water. With borax emits a few bubbles; colours the glass faintly with iron; and is very slowly soluble.

Sapphirine (Th. 218; Al. 207).—Greenland. Scratches quartz feebly. In the forceps it is not altered in any respect; and a fragment is infusible in borax.

Saussurite (Th. 391).—Geneva. Very hard; almost resists the file. In the forceps it intumesces and effervesces a little, and fuses rather readily into a glass slightly blebby. No water. With borax effervesces a little, and fuses rather speedily into a glass coloured by iron.

Scapolite (*Vide* **Nuttalite; Paranthine; Wernerite**). (Th. 271; Al. 139).—Hardness about = 5·5. In the forceps intumesces and effervesces much, and fuses readily into a colourless blebby glass. With borax fuses readily, with continued effervescence, into a clear glass.

Scapolite (Th. 271; Al. 139).—Probably from Arendal. Resists the knife. In the forceps becomes white and opaque; it intumesces and effervesces, and fuses readily into a blebby translucent globule; [soda flame—Ed.] Trace of moisture. With borax it fuses readily, with *continued* effervescence, until the assay is entirely dissolved into a colourless transparent glass; with nitrate of cobalt gives a blue glass. [With microcosmic salt dissolves readily, with continued effervescence, leaving a skeleton.—Ed.]

[**Scapolite, red.**—County Donegal. Fuses, with some difficulty, into a white opaque glass; no soda. With borax, dissolves very slowly, without any effervescence; no iron.—Ed.]

Schwarz-erz (Ph. 313).—Nagyag, Transylvania. Brittle. On charcoal fuses quietly and readily into a dark globule; and, after long roasting, yields a grain of pale-coloured copper; when heated on charcoal it deposits a white powder, which is pale yellow while warm. (Is this Zinc?)

Selenite (Th. 119; Al. 19).—Near Bonmahon, county of Waterford. Yields to the nail. In the forceps becomes white, and fuses readily into a white enamel. Contains much water. A small piece, with nearly an equal portion of powdered fluor spar, on charcoal fuses into a bead, transparent while warm, opaque when cold.

Selenite, lenticular (Th. 119; Al. 19).—Near Paris. In the forceps exfoliates, becomes white, and fuses rather slowly into a white enamel. Contains much water. With borax fuses readily into a clear glass.

[**Serpentine.**—County Galway. In the forceps fuses on the edge, with great difficulty. Contains water (8, p. c.). With borax, fuses slowly into a transparent bead coloured by iron. With microscomic salt, dissolves slowly, with effervescence, leaving a skeleton.—Ed.]

Silver, arsenical antimonial.—Hardness = 3·0; streak dark grey; fresh fracture steel grey, and fine grained. On charcoal emits copious white fumes, with some smell of arsenic at first, and leaves a bead on the charcoal, which, after long roasting, becomes malleable.

Silver, malleable Sulphuret of (Th. 641).—Sombrerete, Mexico. Sectile; cut surface shining. On charcoal it fuses very readily, and leaves a large bead of silver.

Silver Ore, dark red (Th. 648).—Abendroth Mine, Andreasberg, in the Hartz. Yields easily to the knife; streak dark red. On charcoal it decrepitates violently; but when powdered, and moistened, it is speedily reduced.

Silver Ore, dark red, massive,—Hardness about = 3·0; streak dark red; brittle. On charcoal decrepitates, and fuses very readily into a black shining globule, which is soon reduced to a globule, of pure silver; it deposits a yellowish powder at some distance from the assay.

Smaragdite (*Vide* **Hornblende**).—Hardness near 6·0; scarcely yields to the knife; powder white. In the forceps fuses, with very slight effervescence, into a green slightly blebby bead, which becomes pale blue in a strong heat. No water. With borax dissolves very slowly into a glass slightly coloured by iron.

Sodalite (Th. 257; Al. 113; Ph. 127, Jameson,* vol. ii. p. 52).—Kangardluarsuk Fiord, West Greenland. Hardness nearly equal to Felspar; yields to the knife; streak white. In the forceps fuses with effervescence into a colourless blebby glass on the edge, which, in a prolonged blast, is converted into a white infusible scoria, probably owing to the escape of the soda. Contains a little water. With borax it fuses quickly at first, and leaves a porous skeleton, which dissolves slowly into a colourless glass. Reduced to powder, and moistened with nitric acid, it gelatinizes; dissolved in warm dilute nitric acid, it gives a white curdy precipitate with nitrate of silver, which blackens after exposure to light. While fusing, it makes a slight crepitating noise, very like carbonate of soda when fused on platina wire. I could not detect the muriatic acid with microscopic salt and oxide of copper, as recommended by Berzelius.

Sodalite (Th. 257).—Vesuvius. Colourless, and nearly transparent. It is brittle. Contains no water; and agrees with the Greenland variety in its pyrognostic and chemical characters. In the forceps effervesces little, and fuses readily into a colourless globule, slightly blebby. See Annales de Chimie et Physique, tome xxix. p. 17.

Sodalite (Th. 257; Al. 113).—Vesuvius. Of a pale green colour. In the forceps, in the outer flame, it is not affected much; in the inner flame it effervesces and intumesces much, and fuses into a transparent colourless glass, slightly blebby. No water. With borax fuses very slowly into a colourless glass. Reduced to powder, and moistened with nitric acid, does not gelatinize.

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* "A System of Mineralogy," &c., &c. By Robert Jameson. Third edition, 8vo, 3 vols. Edinburgh: 1820.

Sordawalite (Th. 380; Al. 321).—Sordawala, Finland. Brittle; resists the knife. Perfectly opaque. In the forceps intumesces a good deal, and fuses, with slight effervescence, rather readily into a brilliant black bead, not magnetic. Contains some water. With borax emits a few bubbles, and fuses readily into a glass coloured by iron. No manganese.

Sphærosiderite (*Vide* **Carbonate of Iron**). (Al. 42).—Hanau, Germany. Translucent and greenish. Hardness = 4·5; streak white. Does not effervesce with cold muriatic acid; with warm acid it effervesces briskly, and is entirely soluble in it. In the forceps, when gently heated, it blackens and becomes magnetic; in the reducing flame it fuses on the edge into a shining greyish-black magnetic scoria. With borax it effervesces briskly at first, and fuses speedily into a glass deeply coloured by iron; a minute portion fused with borax, so as to tinge it faintly with the iron, and touched with a crystal of nitre, indicates, by the purple colour, the presence of a little manganese; the colour produced by the manganese may be discharged by the reducing flame

Sphærulite (Th. 395; Al. 207).—Schemnitz, Hungary. Hardness = 5·0; brittle; resists the knife. In a very strong heat it becomes transparent, and fuses with difficulty on the edge into a blebby colourless glass. Trace of moisture. With borax it is scarcely soluble.

Sphene (Ph. 258).—Sartut, in Greenland. Hardness = 5·3; streak white. In the forceps, in the outer flame, loses its brown colour, becomes yellow and translucent. In the inner flame it fuses readily on the edge, with some ebullition and slight scintillation, into a dark-coloured scoria; it does not form a bead unless the assay be very minute. No water. With borax it fuses slowly into a glass, yellow while warm, colourless when cold.

Sphene (Ph. 250).—Andernach, on the Rhine. Hardness = 5·2; streak white. In the forceps fuses rather readily on the edge into a dark-coloured glass; the colour of the unfused portion is not altered. No water. With borax it dissolves slowly into a glass, yellow while warm; in the inner flame it is yellow while warm, and brownish when cold.

Spinellane (Th. 257; Al. 114).—Jaher, near Laach on the Rhine. Hardness = 5·5; streak white. In the forceps effervesces slightly, and fuses rather slowly into a colourless blebby glass. No water. With borax fuses rather readily, with prolonged effervescence, into a colourless glass. Reduced to powder, and moistened with nitric acid, it soon gelatinizes.

Spodumene (Th. 302; Al. 109).—Killiney, county Dublin. Resists the knife; hardness about = 6·0. In the forceps, when gently heated, it becomes white and very brittle; [and glows brilliantly—Ed.;] curls up and fuses, with very slight intumescence, into a number of small globules, which require a good blast to unite them in a clear blebby bead. Contains no water. With borax fuses readily at first, leaving a transparent skeleton, which dissolves slowly. At the moment it fuses, it tinges the flame behind the assay carmine-red (proof

of lithia), particularly if the point of the inner flame be let play over the edge of the assay; it is not so readily observed if the assay be entirely enveloped in the flame.

Spodumene (Th. 302; Al. 109).—Dalkey Quarry, near Dublin. Resists the knife. In the forceps intumesces, and fuses, with slight effervescence, into numerous small globules, which unite in a strong heat, and form a blebby globule. No water. With borax dissolves rather slowly.

Steatite (Th. 329; Al. 97).—Rathlin Island, Antrim. Yields easily to the nail; cuts like wax. In the forceps becomes white, and in a strong heat fuses on the edge into a white blebby enamel; a very small fragment forms a bead. Contains much water. With borax slowly soluble [with effervescence.—Ed.].

Steatite (Th. 329; Al. 97).—Gue Grace, Lizard Point, Cornwall. Sectile; does not yield to the nail. In the forceps it fuses rather readily on the edge, with some effervescence, into a white enamel, and a small fragment forms a bead with difficulty. Contains a little water. Dissolves slowly with borax.

[The Steatite of Gue Grace occurs as a Sahlband between the Serpentine porphyry and the Granite veins that penetrate it; it derives its magnesia from the Serpentine, and its alumina from the Granite; the Steatite commonly found in Granite veins, at Luganure and Ballycorus, in the Wicklow and Dublin mountains, contains no magnesia, and is not so soft or fusible as that found in Basalt at Rathlin Island, and it contains less water.—Ed.]

Stilbite, red.—(Th. 344; Al. 125).—Scotland. Yields easily to the knife. In the forceps becomes white; exfoliates, curls up, and fuses into a white blebby globule. Contains much water. With borax it effervesces, and dissolves very rapidly into a colourless glass. [Dissolves readily in microscomic salt, leaving a skeleton.—Ed.] Does not gelatinize with nitric acid.

Stilbite.—Benevenagh, county Derry. Its characters are the same as last.

Strontian, brown carbonate of (Th. 108; Al. 46).—Strontian, Argyleshire. Its pyrognostic characters same as those of the Carbonate.

Strontian, carbonate of (*Vide* **Emmonite**). (Th. 107; Al. 46.)—Golden Bridge, near Dublin. Yields easily to the knife. Effervesces briskly with muriatic acid, and is entirely soluble in it. In the forceps throws out a white cauliflower-like excrescence, tinges the flame behind the assay deep carmine-red, and is infusible. No water. With borax it effervesces much, and fuses very speedily, and in large quantity, into a glass, which is opaque when cold, if saturated.

Strontian, green carbonate of (Th. 107; Al. 46.).—Strontian, Argyleshire. Its pyrognostic characters same as those of the Carbonate.

Strontian, sulphate of (Th. 109; Al. 49).—Bristol. Hardness about = 3·0. In the forceps a large piece decrepitates; a small fragment fuses easily into a white enamel; and when well roasted, it tinges the flame behind the assay carmine-red; but not so strong as the carbonate of Strontian. No water. With borax fuses readily, and in

large quantity, into a glass which becomes opaque when cold, if saturated.

Sulphate of Lime, compact hydrous.—Hardness less than calcareous spar. In the forceps fuses readily into a white opaque globule, which boils a little if intensely heated. Contains much water. With borax dissolves very readily into a clear glass, which becomes opaque when cold, if a sufficient quantity of the assay be used.

Table Spar (*Vide* **Wollastonite**). (Th. 129; Al. 152).—Cziklowa, in the Banat, Temeswar. Does not effervesce with muriatic acid. Yields to the knife. In the forceps fuses, with slight effervescence in the inner flame, into an opaline globule. Contains a little water. With borax fuses slowly into a colourless glass. Dr. Thompson gives the name of Wollastonite to a different mineral (*Qu.* Stellite).

Table Spar (Th. 129; Al. 152).—Hardness about = 3·5. Does not effervesce with nitric acid. In the forceps decrepitates slightly, and fuses readily into a white enamel; in a strong heat it effervesces a little. No water. With borax dissolves readily into a transparent colourless glass.

Table Spar (Th. 129).—Does not effervesce with acid. Hardness about = 4·0. In the forceps it fuses on the edge into a semi-transparent glass, and forms a bead with some difficulty in a prolonged blast. With borax effervesces a little at first, and fuses rather slowly into a colourless glass.

Talc (Th. 357; Al. 90).—St. Stephen's, Cornwall. Yields easily to the knife. In the forceps fuses readily, with some intumescence and effervescence, into a brownish black scoriaceous bead, feebly magnetic. With borax fuses readily, with effervescence, into a glass coloured deeply by iron.

Talc, indurated (Al. 91).—Shetland. Hardness about = 4·0; streak white. Sectile in a low degree. In the forceps fuses, with great difficulty, on its thinnest edges. Trace of moisture. With borax emits a few bubbles, tinges it with iron, and dissolves very slowly. [With microcosmic salt, intumesces and dissolves, leaving a siliceous skeleton.—Ed.]

Talc, Venetian (Th. 186).—Tyrol. Flexible, sectile. Yields to the nail. In the forceps exfoliates and fuses on the edge into a white enamel. No water. With borax effervesces much, dissolves speedily, and in large quantity, into a clear glass not rendered opaque by flaming. Not soluble in hot nitric acid.

Tantalite (*Vide* **Columbite**). (Ph. 272; Th. 484).—Connecticut, North America. Hardness about = 5·25; streak pale reddish-brown. In a good heat it fuses on the edge into an iron-grey glaze; not attracted by the magnet. No water. With borax fuses very slowly into a glass slightly coloured by iron; if saturated, the bead becomes greyish by flaming, and nearly opaque; with borax and nitre gives a trace of manganese. With salt of phosphorus dissolves slowly into a glass coloured by iron while warm; does not become red when cold; therefore, does not contain Tungsten.

Tennantite (Th. 630).—Huel Damsel Mine, St. Day, Cornwall. Brittle; yields easily to the knife; powder dark-grey. On charcoal does not decrepitate; when first heated, it burns with a pale blue flame round the assay; fuses readily; emits sulphurous acid fumes and an arsenical smell for a short time. The fused scoria is attracted by the magnet. When well roasted, a grain of copper will be found on breaking the assay.

Thomsonite (*Vide* **Chalilite**). (Th. 314; Al. 124).—Kilpatrick, near Glasgow. Yields to the knife; hardness about = 5·0. In the forceps it becomes white, exfoliates, intumesces, and fuses readily into a white bead, which, if intensely heated, effervesces a little, and becomes nearly transparent and colourless. Contains water. With borax effervesces a little at first, and fuses readily into a colourless glass. Gelatinizes readily with nitric acid. Thompson says, "it does not melt."

Thomsonite (Th. 314; Al. 124).—From the neighbourhood of Glasgow. Scarcely yields to the knife; hardness about = 5·0–5·2. In the forceps becomes white, intumesces, and fuses, with slight effervescence, into a blebby, semi-transparent, colourless bead. Contains much water. With borax effervesces a little at first, and fuses speedily into a colourless glass, leaving a small skeleton which dissolves slowly. Gelatinizes readily with nitric acid.

Tin, cupreous sulphuret of (Th. 586).—St. Agnes, Cornwall. Hardness = 3·0; streak blackish. On charcoal emits slight sulphurous smell, and fuses very readily into a magnetic bead. Yields copper after long roasting.

Tin, oxide of (Th. 585).—Saxony. Yields with difficulty to the knife; hardness = 6·0; streak white. On charcoal it decrepitates, and in a good reducing flame it yields a malleable globule, brilliant while hot, dull when cold, on account of its rapid oxidation.

Titanium, golden-haired (*Vide* **Rutile**).—Piedmont. Infusible. With borax effervesces briskly at first, and fuses rather slowly into a transparent glass, which is colourless if the assay be small, but, if the proportion of the assay be increased, the glass is yellowish-green while hot, and blackish-brown while cold, by transmitted light; and if saturated, becomes white by flaming. With salt of phosphorus, it effervesces briskly at first; gives a glass, yellow while hot, then greenish, and finally a pale amethyst colour when cold; and leaves a residuum which dissolves very slowly.

Topaz (*Vide* **Pycnite; Pyrophysalite**).

Tourmaline, black.—Bovey Tracey, Devonshire. Resists the knife. In the forceps it fuses readily, with intumescence and effervescence, into a dark-coloured slag. No water. With borax it effervesces, breaks up, and fuses quickly into a glass coloured by iron.

Tourmaline, black.—Land's End, Cornwall. Fuses readily, with much intumescence and effervescence, into a black bead. With borax effervesces and fuses readily into a glass coloured by iron. [With salt of phosphorus dissolves readily, leaving a skeleton of silica; bead

cherry-red when hot, green on cooling, and colourless when cold.—Ed.]

Tourmaline, green.—Chesterfield, America. Resists the knife. In the forceps it fuses on the edge, with slight intumescence, into a greyish-white rough enamel. No water. With borax it effervesces at first, breaks up, and fuses quickly into a clear glass, coloured by iron while warm; with nitrate of potash, manganese is made apparent.

Tourmaline, green.—Killiney, county Dublin. Characters same as last: not so much manganese.

Tremolite, asbestiform (*Vide* **Hornblende**). (Th. 194; Al. 147).—Camborne, Cornwall. Hardness = 4·5. In the forceps fuses, on the edge, with difficulty into a greenish glass, with scarcely any effer-escence. No water. With borax emits some bubbles, and fuses slowly into a colourless glass.

Tremolite, crystallized (Th. 194; Al. 145).—St. Gothard. Hardness about = 5·0. In the forceps, in the inner flame, fuses on the edge, with some effervescence and intumescence, into a blebby white glass, rendered more transparent in a strong heat; and a small fragment forms a bead with difficulty. No water. With borax emits a few bubbles, and fuses rather readily into a glass slightly coloured by iron.

Triphyline.—Bodenmais, Bavaria. Hardness about = 5; streak white. In the forceps fuses readily into an iron-black globule, feebly attracted by the magnet; in a stronger heat the assay spreads over the points of the forceps; heated with some of Turner's test (bisulphate of potash four and a half parts, fluor spar one part) it tinges the flame red. Contains very little water. With borax dissolves speedily into a glass deeply coloured by iron. With nitre it indicates manganese.

Turquoise (*Vide* **Calaite**).

Uranium, oxydulous (Th. 268).—Hardness = 5·5; streak black. Infusible; glazes a little in a strong heat. Contains a good deal of water. With borax it emits some bubbles, and dissolves readily; in the outer flame it is greenish, and contains numerous black floculi; in the inner flame it becomes clearer and of a darker colour.

Voltzine (*Vide* **Zinc oxysulphuret**). (Th. 540).—Lanescot Mine, Cornwall. Hardness = 5·0–5·5; streak white. Decrepitates violently even when reduced to powder and moistened; it deposits on the charcoal a powder, yellow while warm. Contains no water. With borax it breaks up into minute pieces, and dissolves slowly into a glass, colourless while warm, which exhibits milky streaks when cold; by careful flaming it may be made more opaque; in the inner flame it remains transparent when cold, and cannot be made opaque again without a fresh portion of the assay being added. Rare. This appears to be the mamillated blende of Phillips; see his Mineralogy, Third Edition, page 353.

Wavellite (Th. 308; Al. 24).—Clonmel, Tipperary. Yields to the knife; hardness about = 4·0; streak white. In the forceps it becomes white; the fibres diverge, but are infusible. Gives out a good deal of water. With borax fuses readily into a colourless glass, in large quantity; with nitrate of cobalt, becomes blue.

Wernerite (*Vide* **Scapolite**). (Th. 271; Al. 139).—Arendal, Norway. Hardness about = 5·0. In the forceps fuses readily, with intumescence and effervescence, into a colourless blebby glass. No water. With borax fuses readily, with continued effervescence, into a clear glass.

Withamite (Th. 376; Al. 156).—Glencoe, Argyleshire, Scotland. Nearly as hard as Felspar; streak white. Translucent in thin fragments. In the forceps fuses readily, with intumescence and effervescence, into a dark-coloured slag, which melts with some difficulty, on the edge into a black shining glass. No water. With borax fuses readily into a glass coloured by iron while warm; with nitre it indicates the presence of a little manganese.

Wollastonite (*Vide* **Table Spar**). (Th. 130).—Kilsyth, Scotland. Yields to the knife. In the forceps fuses readily into a transparent colourless globule, which effervesces a little in a strong heat. Trace of water. With borax fuses readily, with slight effervescence at first, into a colourless glass, and dissolves in large quantity.

Zinc, blue silicious oxide of.—Catherinenberg, Siberia. Hardness = 4·5; streak white. Does not effervesce with muriatic acid. In the forceps it tinges the flame a fine bright green; intumesces, and fuses on the edge into a white enamel. Contains a good deal of water. With borax it fuses speedily, with effervescence, and in large quantity, into a clear glass, and does not become opaque on cooling, even when saturated.

Zinc, carbonate of.—Hardness = 4·5; streak white. Effervesces with nitric acid. In the forceps becomes yellow while hot, and deposits a powder on the points of the forceps, yellow while warm, white when cold; glazes on the edge. With borax gives a transparent bead, yellow while hot.

Zinc, carbonate of.—Siberia. Hardness = 4·5; streak white. Effervesces with nitric acid when scraped. In the forceps becomes opaque and yellow while hot. Infusible, but is slowly vaporized. Very fine.

Zinc, oxysulphuret (*Vide* **Voltzine**).

Zinc, pale blue silicate of.—Cumberland. Hardness = 4·5; streak white. In the forceps intumesces a little, tinges the flame greenish, and is infusible; it is pale yellow while warm, and white when cold. Contains a little moisture. With borax it dissolves very slowly. With acetate of cobalt it turns blue.

Zinc, silicious oxide of.—Ciklowa, in the Banat. Specific gravity = 3·36. Hardness = 5·0; streak white. In the forceps small fragments fly off; it becomes opaque, white, and brittle; while hot it is yellow,

and tinges the flame pale green, and fuses on the edge into a white enamel. No water. With borax it effervesces at first, and dissolves rather readily into a transparent glass, which is pale yellow while warm, and does not become opaque by flaming, even when saturated. With salt of phosphorus it fuses into a transparent bead, which becomes opaline on cooling, and a portion remains undissolved. Reduced to powder it gelatinizes in muriatic acid in a few minutes.

Zinc, white carbonate of.—Catherinenberg, Siberia. Hardness about = 4·0. Effervesces briskly with muriatic acid. In the forceps infusible, but becomes yellow while warm. No water. With borax it fuses, with prolonged effervescence, into a transparent glass, which, when saturated, becomes opaque on cooling.

Zoisite (*Vide* **Epidote**) (Th. 270; Al. 150).—From Williamsburg, Massachussets, North America. Hardness nearly equal to quartz. In the forceps fuses readily, with intumescence, into a pale green scoria, which glazes on its surface in a very strong heat. No water. With borax fuses readily, with effervescence, into a transparent bead, coloured by iron while warm.

Zoisite (Th. 270; Al. 150).—From Saxony. Resists the knife; hardness about = 7·0. In the forceps it intumesces, effervesces, and fuses readily into a pale green scoria. No water. With borax it dissolves speedily, with effervescence, into a transparent glass, coloured by iron while warm.

Zoisite (Th. 270; Al. 150).—From Strabane, county Tyrone. Resists the knife. In the forceps fuses into a dark green slag. No water. With borax it breaks up, and fuses readily into a clear glass coloured by iron while warm.

Zoisite.—Pfitch, Tyrol. Resists the knife; hardness = 7·0. In the forceps intumesces, effervesces, and fuses readily into a pale green scoria. No water. With borax it dissolves speedily at first, and leaves a residue more slowly soluble; the glass is coloured by iron.

ANNUAL GENERAL MEETING, WEDNESDAY, FEBRUARY 6, 1861.

The Rev. Samuel Haughton, President, in the Chair.

The Society met at 2 o'clock, when the following Report from Council was submitted and adopted:—

REPORT.

The Council have to congratulate the Society on the satisfactory position which it now holds, and the prospects which are open to it of increased usefulness and prosperity.

The number of the Society has been increased during the past year by the addition of eight Honorary Members, two Life Members, two who have paid Half-life Composition, and twenty Annual Members,—making a total accession of thirty-two new Members.

On the other hand, they have to regret the loss by death of one Honorary Member, soon after his election, and of one Life Member; as also the loss of four Annual Members, who, after payment of their subscription, have resigned their connexion with the Society; and of two Annual Members, whose names are now removed from the list in consequence of the non-payment of their liabilities.

The balance of gain to the Society, therefore, amounts to 24, of whom 7 are Honorary Foreign Members, and 17 are Contributing Members.

The finances of the Society are in an equally satisfactory condition, as, after the payment of all liabilities, and the addition of £18 14*s*. to the sum invested in Government Stock, there is a balance in hand of £30 10*s*. 10*d*.

Your Council hope that by continuing for a few years the same care and economy in the management of its funds that has lately been exercised, they may so increase the property of the Society as to acquire a small permanent income, which may be devoted to the more complete illustration of the papers published in the Journal.

The arrangement entered into for the publication of the Journal with the editors of the "Natural History Review" has been brought to a close by the termination of that periodical; but your Council are happy to say that equally satisfactory arrangements have been made for the future.

The Society will henceforward print 250 copies of its Journal for the use of its Members and for exchange with Scientific Institutions, and will also unite with other Scientific Societies in printing extra copies for a new scientific "Quarterly Journal of Science," under the editorship of our President, copies of which will be sent to the principal Libraries of Europe and America. The cost of printing will be about £4 10*s*. 0*d*. per sheet, instead of £5, as before.

In the Appendix will be found, as usual:—

1st. A list of the Members now on the books of the Society.

2nd. A list of the Members gained and lost during the past twelve months.

3rd. An abstract of the Treasurers' account for the year 1860.

4th. A list of the Donations received during the year.

5th. A list of the Societies and Institutions to whom a copy of the Journal is forwarded.

APPENDIX TO ANNUAL REPORT.

No. I.

LIST OF MEMBERS, CORRECTED TO JANUARY 31, 1861.

Members are requested to correct errors in this List, by letter to the REV. SAMUEL HAUGHTON, *Trinity College, Dublin.*

HONORARY MEMBERS.

Elected.
1844. 1. Boué, Ami, For. Mem., L. G. S., *Paris.*
1861. 2. Daubree, M., *Strasbourg.*
1861. 3. Delesse, M., Ingenieur des Mines, *Paris.*
1861. 4. De Serres, M. Marcel, *Montpelier.*
1861. 5. Deville, M. Charles, *Paris.*
1861. 6. Deville, M. Ste Claire, *Paris.*
1861. 7. De Koninck, M. L., *Liege.*
1861. 8. Geinitz, M. H. B., *Dresden.*
1844. 9. Lyell, Sir Charles, F. R. S., 53, *Harley-street, W., London.*
1844. 10. Murchison, Sir Roderick I., F. R. S., 16, *Belgrave-square, London.*
1832. 11. Sedgwick, Rev. A., F. R. S., *Cambridge.*

HONORARY CORRESPONDING MEMBERS.

1854. 1. Thomas Oldham, F. R. S., *India.*
1854. 2. Arthur A. Jacob, C. E., *India.*
1855. 3. Joseph Medlicott, *India.*
1859. 4. John Gordon, C. E., *India.*
1859. 5. Henry J. B. Hargrave, C. E., *India.*
1859. 6. John Hime, C. E., *Pernambuco.*

MEMBERS WHO HAVE PAID LIFE COMPOSITION.

1853. 1. Allen, Richard Purdy, *Austin Friars, London.*
1861. 2. Brown, Markham, *Connoree Mines, Ovoca.*
1857. 3. Carson, Rev. Joseph, D. D., F. T. C. D., *Trinity College.*
1832. 4. Davis, Charles, M. D., 33, *York-street.*
1861. 5. Fottrell, Edward, *Upper Leeson-street.*
1857. 6. Greene, John Ball, 6, *Ely-place.*
1857. 7. Haliday, A. H., A. M., F. L. S., M. R. I. A., *Harcourt-street.*
1831. 8. Hamilton, Sir W. R., M. R. I. A., *Observatory, Dunsink.*
1848. 9. Haughton, Rev. Professor, F. R. S., 40, *Trinity College.*
1850. 10. Hone, Nathaniel, M. R. I. A., *St. Doulough's, Co. Dublin.*
1831. 11. Hutton, Robert, F. G. S., *Putney Park, London.*
1851. 12. Jukes, Joseph Beete, F. R. S., 51, *Stephen's-green.*
1834. 13. King, Hon. James, M. R. I. A., *Mitchelstown.*
1844. 14. King, John, *Dame-street.*
1856. 15. Lentaigne, John, M. D., *Great Denmark-street*
1848. 16. Luby, Rev. Thomas, D. D., F. T. C. D., *Trinity College.*
1851. 17. Malahide, Lord Talbot de, F. R. S., *Malahide Court, Malahide.*
1838. 18. Mallet, Robert, C. E., F. R. S., 1, *Grosvenor-terrace, Monkstown, Co. Dublin*, and 11, *Bridge-street, Westminster, London, S. W.*
1846. 19. Murray, B. B., 69, *Lower Gardiner-street.*
1859. 20. Ogilby, William, F. R. S., *Liscleen, Dunmanagh, Co. Tyrone.*
1849. 21. Sidney, F. J., LL. D., 10, *Herbert-street.*
1851. 22. Whitty, John Irvine, LL. D., *Henrietta-street.*

MEMBERS WHO HAVE PAID HALF LIFE COMPOSITION.

Elected.

1831. 1. Baillie, Rev. James Kennedy, D. D., *Ardtrea, Stewartstown.*
1854. 2. Barnes, Edward, *Ballymurtagh, Co. Wicklow.*
1832. 3. Bryce, James, *High School, Glasgow.*
1855. 4. Clarke, Edward, 3, *Frankfort Buildings, Rathgar.*
1854. 5. Clemes, John, *Luganure Mine, Glendalough, Co. Wicklow.*
1857. 6. Crawford, Robert, C. E., *care of Messrs. Peto and Betts*, 9, *Great George's-street, Westminster.*
1861. 7. Crosbie, George, *Ardfert Abbey, Ardfert, Tralee.*
1861. 8. Dunally, Lord, *Kilboy, Nenagh.*
1856. 9. Du Noyer, G. V., M. R. I. A., 51, *Stephen's-green.*
1832. 10. Dunraven, Earl of, F. R. S., *Adare, Co. Limerick.*
1836. 11. Enniskillen, Earl of, M. R. I. A., *Florence Court, Enniskillen.*
1844. 12. Esmonde, Sir Thomas, Bart., M. R. I. A., 9, *Johnstown Castle, Wexford.*
1854. 13. Foote, Frederick J., 51, *Stephen's-green.*
1853. 14. Harkness, Professor, F. G. S., *Queen's College, Cork.*
1856. 15. Haughton, Lieut. John, R. A., *St. Helena.*
1857. 16. Haughton John Hancock, Esq., *Carlow.*
1850. 17. Head, Henry, M. D., *Lower Fitzwilliam-street.*
1858. 18. Hill, J., C. E., *Tullamore.*
1840. 19. Jackson, James E., *Tulliderry, Blackwatertown.*
1839. 20. James, Sir H., Colonel, R.E., F.R.S., *Ordnance Survey Office, Southampton.*
1858. 21. Jones, Rev. Henry Hampden, *Adare, Co. Limerick.*
1832. 22. Kearney, Thomas, *Pallasgreen, Co. Limerick.*
1857. 23. Keane, Marcus, *Beech Park, Ennis, Co. Clare.*
1835. 24. Kelly, John, 38, *Mountpleasant-square.*
1853. 25. Kinahan, George H., *St. Kilda, Sandycove, Dalkey.*
1839. 26. Lansdowne, Marquis of, 54, *Berkeley-square, London.*
1838. 27. Larcom, Major-General, R E., LL. D., F. R. S., *Phœnix Park.*
1858. 28. Leech, Major, R. E., *Mountjoy Barracks, Phœnix Park.*
1840. 29. Lindsay, Henry, L., C. E.
1832. 30. Mac Adam, James, F. G. S., 18, *College-street, East, Belfast.*
1840. 31. Montgomery, James E., M. R. I. A.
1856. 32. Molony, C. P., Capt., 25th Regt., Madras, N. I., *per Messrs. Grinlay and Co.*, 3, *Cornhill, London.*
1856. 33. Medlicott, Henry, *Roarkee, Bombay.*
1857. 34. M'Ivor, Rev. James, *Rectory, Moyle, Newtownstewart, Co. Tyrone.*
1845. 35. Neville, John, C. E., M. R. I, A., *Dundalk.*
1852. 36. O'Kelly, Joseph, 61, *Stephen's-green.*
1844. 37. Palmerston, Viscount, G. C. B., M. P., 4, *Carlton Gardens, London.*
1832. 38. Portlock, Major-Gen., R. E., F. R. S., 58, *Queen's Gardens, Hyde Park.*
1832. 39. Renny, Henry L., R. E., *Canada.*
1854. 40. Smyth, W. W., *Jermyn-street, London.*
1832. 41. Tighe, Right Hon. William, *Woodstock, Innistiogue.*
1834. 42. Verschoyle, Archdeacon, *Rathbarron, Collooney.*
1853. 43. Webster, William B., 104, *Grafton-street.*
1846. 44. Willson, Walter, 51, *Stephen's-green.*
1854. 45. Wyley, Andrew, 51, *Stephen's-green.*
1857. 46. Wynne, Arthur B., F. G. S., 51, *Stephen's-green.*

ANNUAL MEMBERS.

1861. 1. Andrews, William, *The Hill, Monkstown.*
1831. 2. Apjohn, James, M. D., F. R. S., *South-hill House, Blackrock.*
1857. 3. Baily, W. H., F. G. S., 51, *Stephen's-green.*
1857. 4. Bandon, Earl of, *Castle Bernard, Bandon, Co. Cork.*

Elected.
1859. 5. Barker, John, M. B., 64, *Waterloo-road.*
1864. 6. Barrington, C. E., *Fassaroe, Bray.*
1855. 7. Barton, H. M., 5, *Foster-place.*
1861. 8. Barton, John, *Stone House.*
1859. 9. Battersby, Francis, M. D., 16, *N. Cumberland-street.*
1844. 10. Bective, Earl of, *Headford, Kells.*
1858. 11. Bermingham, J., *Millbrook, Tuam.*
1857. 12. Bolton, George, Jun., 8, *Upper Ormond-quay.*
1881. 13. Brady, Right Hon. Maziere, Chancellor, 26, *Upper Pembroke-street.*
1861. 14. Brownrigg, W. B., 18, *Adelaide-road.*
1840. 15. Callwell, Robert, M. R. I. A., 25, *Herbert-place.*
1857. 16. Carte, Alexander, A. M., M. D., *Royal Dublin Society.*
1858. 17. Cotton, Charles, *Mallow Railway Company, Mallow.*
1857. 18. Craig, G. A., C. E., 6, *Ely-place.*
1834. 19. Croker, Charles P M. D., 7, *Merrion-square, West.*
1846. 20. D'Arcy, Matthew, M. R. I. A.. *Anchor Brewery, Ussher-street.*
1849. 21. Downing, Samuel, C.E., LL. D., 6, *Trinity College.*
1857. 22. Dowse, Richard, *Blessington-street.*
1832. 23. Dublin, The Archbishop of, *The Palace, Stephen's-green.*
1852. 24. Doyle, J. B., *Martello-terrace, Sandymount.*
1853. 25. De Vesci, Lord, *Abbeyleix House, Abbeyleix.*
1857. 26. Farran, Charles, M. D., *Feltrim, Malahide.*
1856. 27. Fleming, Lionel J., C. E., 2, *Henrietta-street.*
1861. 28. Foot, William, 23, *Rutland-square.*
1857. 29. Frith, R. J., C. E., *Leinster-road, Rathmines.*
1858. 30. Gages, Alphonse, M. R. I. A., 51, *Stephen's-green.*
1849. 31. Galbraith, Rev. Joseph A., F. T. C. D., *Trinity College.*
1856. 32. Ganley, Patrick, 6, *Ely-place.*
1861. 33. Gillespie, W., 24, *Merrion-street.*
1849. 34. Gyles, A. M'Gwire, *Saunders' Court, Kyle, Enniscorthy.*
1861. 35. Greene, F. W., 46, *Dame-street.*
1859. 36. Green, Murdock, 52, *Lower Sackville-street.*
1831. 37. Griffith, Sir R., Bart., LL. D., 2, *Fitzwilliam-place.*
1852. 38. Gordon, Samuel, M. D., 11, *Hume-street.*
1856. 39. Good, John, *City-quay.*
1857. 40. Hampton, Thomas, C. E., 6, *Ely-place.*
1848. 41. Harvey, Professor, M. D., F. R. S., 40, *Trinity College.*
1861. 42. Hone, Joseph, Jun., 35, *Lower Leeson-strert.*
1861. 43. Hutton, C., M. D., 5, *Merrion-square.*
1834. 44. Hutton, Thomas, F. G. S., 116, *Summer-hill.*
1852. 45. Jellett, Rev. Professor, F. T. C. D., M. R. I. A., 6, *Trinity College.*
1842. 46. Jennings, F. M., M. R. I. A., F. G. S., *Brown-street, Cork.*
1858. 47. Jones, William, C. E., 6, *Ely-place.*
1861. 48. Joy, R., 33, *Mountjoy-square.*
1856. 49. Kinahan, J. R., M. D., M. R. I. A., F. L. S., *St. Kilda, Sandycove, Dalkey.*
1853. 50. Kingsmill, Thomas W., Jun., *Sidmonton, Bray.*
1861. 51. Lisabe, F., C. E., 42, *Sackville-street.*
1831. 52. Lloyd, Rev. Humphrey, D. D., F. T. C. D., 35, *Trinity College.*
1854. 53. Longfield, Rev. George, F. T. C. D., *Trinity College.*
1861. 54. Lyster, J., C. E., *Stillorgan Castle, Stillorgan.*
1855. 55. M'Causland, Dominick, 12, *Fitzgibbon-steeet.*
1861. 56. M'Comas, A., 23, *Rathmines-road.*
1851. 57. M'Donnell, John, M. D., 4, *Gardiner's-row.*
1852. 58. Mac Donnell, Rev. Richard, D. D., Provost of Trinity College, *Provost's House, Trinity College.*
1837. 59. Mollan, John, M. D., 8, *Fitzwilliam-square, North.*
1851. 60. M'Dowell, George, F. T. C. D., 6, *Trinity College.*
1849. 61. M'Guire, Thomas, 46, *Kildare-street.*

Elected.		
1859.	62.	Moore, Joseph Scott, *The Manor, Kilbride, Co. Dublin*
1861.	63.	Morris, J. B., *Oaklands, Sandymount.*
1831.	64.	Nicholson, John, M. R. I A., *Balrath House, Kells.*
1856.	65.	O'Brien, Octavius, 23, *Kildare-street.*
1859.	66.	O'Grady, M. T., 35, *Blessington-street.*
1832.	67.	Patten, John, *Royal Dublin Society.*
1848.	68.	Petherick, John, *Surbiton, Kingston-on-Thames, Surrey.*
1857.	69.	Porter, William, C. E., 13, *Charlemont-mall.*
1861.	70.	Regan, George, 32, *Frederick-street.*
1857.	71.	Reeves, R. S., 22, *Upper Mount-street.*
1861.	72.	Roberts, W. G., 32, *Frederick-street.*
1856.	73.	Robinson, Hartstonge, 15, *St. James'-terrace, Malahide.*
1861.	74.	Smith, George, *College-green.*
1852.	75.	Smith, Robert, M. D., 63, *Eccles-street.*
1852.	76.	Sanders, Gilbert, M. R. I. A., 2, *Foster-place.*
1854.	77.	Scott, Robert H., A. M., 13, *Suffolk-street.*
1857.	78.	Stack, Rev. Thomas, F. T. C. D., *Trinity College.*
1859.	79.	Stokes, William, M. D., *Merrion-square.*
1861.	80.	Stoney, Bindon, C. E., 89, *Waterloo-road.*
1857.	81.	Tait, Alexander, C. E., *Santry.*
1859.	82.	Waldron, L., M. P., LL. D., *Ballybrack, Dalkey.*
1861.	83.	Waller, J. F., LL. D., 4, *Herbert-street.*
1859.	84.	Walker, William F., 9, *Trinity College.*
1832.	85.	Wall, Rev. C. W., D. D., Vice-Provost, *Trinity College.*
1857.	86.	Welland, W. T., 48, *Upper Rutland-street.*
1859.	87.	Wilde, W. R., M. D., *Merrion-square.*
1851.	88.	Wright, Edward, LL. D., M. R. I. A., *Floraville, Donnybrook.*
1853.	89.	Wright, E. Perceval, M. B., A. M., F. L. Z. SS., *Museum, Trinity College.*

ASSOCIATES FOR THE YEAR.

1. Bateman, C. W., 56, *Camden-street.*
2. Ball, R., 2, *Granby-row.*
3. Birch, J. G., 2, *Adelaide-terrace.*
4. Crosthwaite, J., 17, *Trinity College.*
5. Doyle, E. W., *Martello-terrace.*
6. Gibbon, W., *The Cottage, Sandymount.*
7. Glennon, J., *Dolphin's-barn.*
8. Grubb, H., 15, *Leinster-square.*
9. Hart, H. M., 25, *Trinity College.*
10. Hassard, R., 13, *Pleasant-street.*
11. Jacob, A. H., 1, *Brighton-avenue, Monkstown.*
12. Jameson, J., *Portmarnock, Malahide.*
13. Knapp, W., 6, *Belgrave-square.*
14. Leeson, G., 1, *Grantham-place.*
15. Lyster, J., 37, *Trinity College.*
16. M'Donnell, J., *Model Farm, Glasnevin.*
17. M'Grorty, J., 8, *St. Andrew-street.*
18. Persse, De Burgh, 19, *Trinity College.*
19. Patterson, B. G., 1, *Sandford-terrace.*
20. Robinson, W., 20, *Holles-street.*
21. Scott, J. M., *Ballygannon, Kilcool.*
22. Smith, G., 9, *Trinity College.*
23. Trail, B., 4, *Mountpelier-parade.*
24. Wilkinson, M., 1, *Great Brunswick-street.*

No. II.

MEMBERS GAINED AND LOST FOR THE YEAR ENDING JANUARY 31, 1861.

GAINED.

Honorary Members.

1. M. Daubree, *Strasburg.*
2. M. Delesse, Ingenieur des Mines, *Paris.*
3. M. Durocher, *Rennes.*
4. M. Marcel de Serres, *Montpelier.*
5. M. Ste Claire Deville, *Paris.*
6. M. Charles De Ville, *Paris.*
7. M. L. de Koninck, *Liege.*
8. M. H. B. Geinitz, *Dresden.*

Life Members.

1. Brown, Markham, *Connoree Mines, Ovoca.*
2. Fottrell, Edward, *Upper Leeson-street.*

Members who have paid Half-Life Composition.

1. Crosbie, George, *Ardfert Abbey, Ardfert, Tralee.*
2. Dunally, Lord, *Kilboy, Nenagh.*

Annual Members.

1. Andrews, William, *The Hill, Monkstown.*
2. Barton, John, *Stone House.*
3. Barrington, C. E., *Fassaroe, Bray.*
4. Brownrigg, W. B., 18, *Adelaide-road.*
5. Chambers, M., 6, *Merrion-terrace.*
6. Foot, William, 23, *Rutland-square.*
7. Gillespie, W., 24, *Merrion-street.*
8. Greene, F. W., 46, *Dame-street.*
9. Hutton, C., M. D., 5, *Merrion-square.*
10. Hone, Joseph, Jun., 35, *Lower Leeson-street.*
11. Joy, R., 33, *Mountjoy-square.*
12. Lisabe, F., C. E., 42, *Sackville-street.*
13. Lyster, J., C. E., *Stillorgan Castle, Stillorgan.*
14. Morris, J. B., *Oaklands, Sandymount.*
15. M'Comas, A., 23, *Rathmines-road.*
16. Roberts, W. G., 32, *Frederick-street.*
17. Regan, George, 32, *Frederick-street.*
18. Smith, George, *College-green.*
19. Stoney, Bindon, C. E., 89, *Waterloo-road.*
20. Waller, J. F., LL. D., 4, *Herbert-street.*

MEMBERS LOST.

DECEASED.

Honorary Member.

1. M. Durocher, *Rennes.*

Life Member.

1. Carter, Sampson, C. E., *Kilkenny.*

RESIGNED.

Annual Members.

1. Ashton, Samuel, *Woodfield, Newtownbarry.*
2. Chambers, M., 6, *Merrion-terrace, Merrion.*
3. Hemans, G., C. E., 10, *Rutland-square.*
4. O'Meara, Rev., E., *Brunswick-street.*

Subscriptions in Arrear.

1. Irwin, George, C. E., 6, *Ely-place.*
2. Phayre, G., C. E., 60, *Dominick-street.*

State of the Society at the commencement of—

	1860.	1861.
Honorary Members,	4	11
Corresponding do.,	6	6
Life do.,	64	68
Annual do.,	76	89
	150	174

No. III.

DONATIONS RECEIVED TO 31st JANUARY, 1861.

Amsterdam.—Academie Royal des Sciences Amsterdam. Verhandlungen, Part VII. Verslagen, Part IX. Catalogue of Library, Parts 1 and 2. Presented by the Academy.

Brussels.—Annuaire de l'Academie Royal des Sciences, &c., de Belgique, 1859 and 1860. Presented by the Academy.

——— Bulletins de l'Academie Royal des Sciences, des Lettres et des Beaux Arts, Nos. 4, 5, 6. Presented by the Academy.

Berlin.—Zeitschrift für Allgemeine Erdkunde, Nos. 76, 77, 78, 82, 84, 85, 86. Presented by the Geographical Society.

——— Zeitschrift für die Gesammtenn Naturwissenchaften, Vols. XI., XII. Presented by the Editors,

Calcutta.—Memoirs of the Geological Survey of India, Vol. II., Part 1. Presented by Professor Oldham, Director-General.

California.—Reports of the Geology, Botany, and Zoology of Northern California and Oregon. By J. L. Newbury, M. D. Presented by the Author.

Canada.—Canadian Journal of Industry, Science, and Art, Nos. 24 to 30. Presented by the Editors.

Charleston.—Proceedings of the Elliott Society of Natural History, No. 1. Presented by the Society.

Cornwall.—Annual Report of the Royal Cornwall Polytechnic Society, 1859. Presented by the Society.

Copenhagen.—Review of the Royal Danish Academy of Sciences of Copenhagen. Presented by the Academy.

Dublin.—Natural History Review, Vols. V., VI., VII., and Vol. I., New Series. Presented by the Editors.

——— Proceedings of the Natural History Society, Vol. I. Presented by the Society.

——— The Atlantis, Nos. 2, 3, 4, 5. Presented by the Editor.

Edinburgh.—Proceedings of the Society of Antiquaries of Scotland, Vol. II., Part 1. Presented by the Society.

——— Transactions of the Royal Scottish Society of Arts, Vol. V., Parts 3 and 4. Presented by the Society.

Geological Survey of Ireland.—Thirteen Quarter-sheets of the Geological Map of Ireland. Presented by Sir R. Murchison, Director-General.

——— Nine Books of Data.

Hanau.—7th & 8th Bericht der Ober-Hessischen Gesellschaft, der Natur & Heilkunde. Presented by the Society.

——— Jahresbericht der Wetterauer Gesellschaft für die gesammte Naturkunde zu Hanau, über die Gesellschafts-Jahre von August 1855 bis 1857, & die 50-Jährige Jubelfeier, Aug 1858. Presented by the Society.

——— Naturhistorische Abhandlungen aus dem Gebiete der Wetterau, August, 1858. Presented by the Society.

Iowa.—Geology of Iowa, Vol. I., Parts 1 and 2. Presented by the Author.

Kilkenny.—Proceedings and Papers of the Kilkenny and South-East of Ireland Archæological Society, Vol. II., Nos 23, 24, 25, 26, 27. Presented by the Society.

Lancashire.—Transactions of the Historic Society of Lancashire and Cheshire, Vol. XII. Presented by the Society.

Lausanne.—Bulletin de la Societé Vaudoise des Sciences Naturelles, Vol. VI., Nos. 44, 45, 46. Presented by the Society.

Leeds.—Annual Report of the Leeds Philosophical Society, 1859–60. Presented by the Society.

Liverpool.—Proceedings of the Literary and Philosophical Society of Liverpool, No. 14. Presented by the Society.

London.—Journal of the Proceedings of the Linnean Society; Supplement to Vol. IV.; Botany, Vol. IV., Nos. 16, 17. Presented by the Society.

——— Quarterly Journal of the Geological Society of London, Nos. 60, 61, 62, 63, and 64. Presented by the Society.

——— Proceedings of the Royal Geographical Society, Vol. IV., Nos. 1, 2, 3, and 5. Presented by the Society.

——— Journal of the Royal Geographical Sooiety, Vol. XXIX. Presented by the Society.

——— Proceedings of the Zoological Society, pp. 369–560, Part 3, 1859, and Parts 1 and 2, 1860. Presented by the Society.

——— Report of the British Association for the Advancement of Science, Aberdeen 1859. Presented by the Association.

——— Proceedings of the Royal Institution of Great Britain, Part 10. Presented by the Institution.

——— Proceedings of the Institution of Civil Engineers, Vols. VII., VIII., X., XIII., XVI., XVII., XVIII. Presented by the Institution.

Lyons.—Memoires de l'Academie Imp. des Sciences, &c., de Lyons, Classes des Lettres, VII. Classe Science, VII. et IX. Presented by the Academy.

——— Annales de la Societé Imp. d'Agriculture de Lyons, 3rd Series. II., III. Presented by the Society.

Manchester.—Transactions of the Geological Society of Manchester, Parts 2 to 9, and Nos. 1 and 2, Session 1860. Presented by the Society.

——— Annual Report of the Manchester Geological Society, 1859. Presented by the Society.

——— Proceedings of the Literary and Philosophical Society of Manchester, 1858–9, Nos. 1–16; 1859–60, Nos. 1–14. Presented by the Society.

——— Memoirs, 2 Series, Vol. XV. Presented by the Society.

Missouri.—Geological Report of the Country along the Line of the S. W. Branch of the Pacific Railway, State of Missouri. By G. S. Swallow, State Geologist. Presented by the Author.

Munich.—Sitzungsberichte der Königl Bayer: Akademie der Wissenschaften zu München 1860, Nos. 1 and 2. Presented by the Academy.

Neuchatel.—Memoires de la Societe des Sciences Naturelles de Neuchatel, Vols. IV. and V. Presented by the Society.

Newhaven.—American Journal of Science and Arts, Nos. 84–90. Presented by the Editor.

——— Journal of the Elliott Society of Natural History, Vol. I., Parts 1 and 2. Presented by the Society.

Philadelphia.—Proceedings of the Academy of Natural Sciences of Philadelphia, 1859, pp. 1–284. Presented by the Academy.

——— Extracts from the Proceedings, &c., of Papers, per Isaac Lea, LL. D. Presented by the Academy.

——— Observations of the Genus Unio. By Isaac Lea, LL. D. Presented by the Academy.

St. Louis.—Transactions of the Academy of Natural Sciences of St. Louis, Vol. I., No. 3. Presented by the Society.

St. Petersburg. — Verhandlungen der Russich Kaiserlichen Mineralogischen Gesellschaft, 1831, 1856, 13 Parts.

——— Figures and Descriptions of Canadian Organic Remains, Decades 1, 3, and 4. Presented by Sir W. B. Logan.

Vienna.—Jahrbuch der KK. Geolog. Reichsanstalt, 1859, Parts 3 and 4, No. 1, 1860.

Washington.—Report of the Superintendent of U. S. Coast Survey for 1857. By Professor A. D. Bache. Presented by the Author.

York.—Proceedings of the Geological and Polytechnic Society of Yorkshire, 1859. Presented by the Society.

Presented by the Authors.

Austin.—On Lower Silurian Rocks on the S. E. of Ireland. By Major Austin, F. G. S. Presented by the Author.

Barrande.—On the Primordial Fauna and Taconic System. By J. Barrande. With additional Notes by Jules Marcon. Presented by the Author.

Dalton.—On the Phosphates and Arseniates. By John Dalton, D. C. L., F. R. S. presented by the Author.

Lord De Grey.—Address delivered at the Annual Meeting of the Royal Geographical Society, May, 1860. By the Earl De Grey and Ripon. Presented by the Author.

M'Clintock.—Meteorological Abstract from the Fox. By Captain Sir L. M'Clintock. Presented by the Author.

Stoves.—The Alloys of Copper and Zinc. By J. H. Stoves. Presented by R. Mallet, Esq., C. E.

No. IV.

SOCIETIES AND INSTITUTIONS ENTITLED TO RECEIVE THE JOURNAL OF THE GEOLOGICAL SOCIETY OF DUBLIN.

ABERDEEN, .	University Library.
ALBANY, . .	State Library, New York.
AMSTERDAM, .	Royal Academy of Sciences.
BELFAST, . .	Queen's College Library.
BERLIN, . .	Royal Academy of Sciences.
	German Geological Society, per Bessersche Buchhandlung, *Behren-str.*, 7, *Berlin.*
BORDEAUX, .	Imperial Academy of Sciences.
BOSTON, . .	American Academy.
	Natural History Society.
BRISTOL, . .	Institution for the Advancement of Science, Literature, and the Arts.
BRUSSELS, .	Academy of Sciences.
CALCUTTA, .	Public Library.

CAMBRIDGE, . Philosophical Society.
University Library.
COPENHAGEN, Royal Society of Science.
CORK, . . . Queen's College Library.
CORK, . . . Royal Institution.
CORNWALL, . Royal Polytechnic Institution.
DIJON, . . Academy of Sciences.
DUBLIN, . . Royal College of Surgeons' Library.
Royal Irish Academy.
University Library.
Royal Dublin Society.
Natural History Society.
Ordnance Survey Library.
Geological Survey of Ireland.
University Philosophical Society.
University Zoological and Botanical Association.
EDINBURGH, . Royal Society.
Wernerian Society.
Society of Arts.
University Library.
FLORENCE, . Society of Physics and Natural History.
GALWAY, . . Queen's College Library.
GENOA, . . Society of Physics.
GLASGOW, . University.
GÖTTINGEN, . University.
HANOVER, . Royal Library.
KILKENNY, . Archæological Society.
LAUSANNE, . Société Vaudoise des Sciences Naturelles.
LEEDS, . . Geological and Polytechnic Society of the West Riding of Yorkshire.
Philosophical and Literary Society,
LEIPZIC, . . Royal Academy of Sciences (Saxony).
University.
LIVERPOOL, . The Literary and Philosophical Society.
Historic Society of Lancashire and Cheshire.
LONDON, . . Geological Survey, *Jermyn-street.*
British Museum.
Society of Arts, *John-street, Adelphi.*
Royal Institution, *Albemarle-street.*
Royal Society, *Burlington House.*
Geological Society, *Somerset House.*
Linnean Society, *Burlington House.*
Geographical Society, 15, *Whitehall-place.*
Civil Engineers, Institution of, 25, *Great George's-street, Westminster.*
Royal Asiatic Society, 5, *New Burlington-street.*
Royal College of Surgeons.
Zoological Society, 11, *Hanover-square.*
Athenæum, 14, *Wellington-street, Strand, W. C.*
Literary Gazette.
The Hon. the East India Company, *East India House.*
LYONS, . . . La Société Imperiale d'Agriculture, d'Histoire Naturelle, et des Arts Utiles.
Societe Linneen de.
Academie Imperiale de.
MANCHESTER, Literary and Philosophical Society of. [Sec., R. C. Christie].
Geological Society.
MELBOURNE, . Philosophical Institute of Victoria.
MILAN, . . Imperial Institute of Science.
MISSOURI, . . State Survey and University, *Geological Rooms, Columbia, U. S. A.*

Modena, . .	Imperial Institute of Science.
Munich, . .	Royal Academy of Science.
Neuchatel, .	Societé des Sciences Naturelles.
New Haven,	The Editors of Silliman's Journal of Science and Art.
Oxford, . .	Bodleian Library.
	Ashmolean Society.
Paris, . . .	Ecole Polytechnique.
	Geological Society.
	L'Ecole Imp. des Mines.
	Institute of France.
	Bibliotheque Imp.
	Jardin des Plantes, Bibliotheque.
Philadelphia,	American Philosophical Society.
	Natural History Society.
Plymouth, .	Plymouth Institution and Devon and Cornwall Natural History Society.
Quebec, . .	Literary and Historical Society.
Rouen, . .	Academy of Science.
Rome, . . .	The Vatican Library.
St. Andrews,	University Library.
St. Petersburg,	Imperial Academy.
	Central Physical Observatory of Russia.
Stockholm, .	Royal Academy of Science.
Strasbourg,	Société des Sciences Naturelles de.
Toronto, C.W.,	Canadian Institute, per Thomas Henning, Esq.
Toulouse, .	Academy of Sciences.
Turin, . . .	Royal Academy.
Upsala, . .	Royal Society of Sciences.
Vienna, . .	Imperial Academy of Sciences.
	Prof. W. Haidinger, of Vienna, as Editor of the "Jahrbuch der K. K. Geologischen Reichsanstalt."
Washington,	Smithsonian Institute Library, per Henry Stevens, Esq., *Morley's Hotel, Trafalgar-square, London.*

No. V.—ABSTRACT OF TREASURER'S ACCOUNT FOR THE YEAR ENDED DECEMBER 31, 1860.

Dr.—1860.		£ s. d.
To Balance from last year's Account,		13 9 11
— Amount of Subscriptions received for year ending December 31, 1860:—		
— Life Compositions,	£30 0 0	
— Half-life Compositions,	5 0 0	
— Admission Fees,	19 0 0	
— Annual Subscriptions,	76 0 0	
		130 0 0
— Amount of Dividend received on Government Stock,	2 14 8	
— Do. received for Books sold,	1 5 0	
		3 19 8
		£147 9 7

Cr.—1860.		£ s. d.
By Editors of "Natural History Review," to June 30, 1860 (per Draft 532),		15 0 0
— Assistant Secretary's half-year's Salary, to June 30, (per Draft 533),		10 0 0
— Editors of "Natural History Review," to Dec. 31, (per Draft 534),		15 0 0
— Sundries, per Assistant Secretary, (per Draft 535),	7 11 5	
— Porter's Wages,	7 10 0	
— Gratuity to Attendant,	1 10 0	
— Carriage of Books,	0 19 6	
— Keogh, for Binding,	1 9 3	
		19 0 2
— Treasurer, to invest in Government Funds (per Draft 536),	19 0 0	
— Do., less, overdrawn,	0 6 0	
		18 14 0
— Editors of "Natural History Review," to Dec. 11, for printing additional matter (per Draft 537),		6 5 0
— Mr. Gill, for Printing for one year, to Dec. 19 (per Draft 538),		6 9 3
— Sundries, per Assistant Secretary (per Draft 539),	4 10 6	
— Carriage of Books,	2 4 6	
— Mr. Oldham's Account for Lithographs,	1 7 0	
— Mr. Tallon's Account for Stationery,	1 18 4	
— Porter's Wages,	6 10 0	
		16 10 4
— Assistant Secretary, Salary to December 31, 1860, (per Draft 540),		10 0 0
		£116 18 9
— Balance in Bank,	£23 19 10	
— Cash in hands,	6 11 0	
		30 10 10
		£147 9 7

Jan. 30, 1861.

GILBERT SANDERS, *Treasurer.*

The ballot having closed, the following gentlemen were declared duly elected:—

President.—Rev. Professor Haughton, F.R.S.

Vice-Presidents.—Robert Callwell, Esq.; Robert Mallet, C. E., F.R.S.; James Apjohn, M.D., F.R.S.; Professor W. H. Harvey, M.D., F.R.S.; Rev. H. Lloyd, D.D., F.R.S.

Treasurers.—Gilbert Sanders, Esq.; F. J. Sidney, LL.D.

Secretaries.—Joseph Beete Jukes, M. A., F. R. S.; Robert H. Scott, M. A.

Council.—Lord Talbot de Malahide; Sir Richard Griffith, Bart., LL.D.; John Kelly, Esq.; Samuel Downing, LL.D., C.E.; John B. Doyle, Esq.; J. R. Kinahan, M. D., F. L. S.; Alexander Carte, M. D.; Edward Wright, LL.D.; Samuel Gordon, M.D.; William H. Baily, F. G. S.; Alphonse Gages, M. R. I. A.; R. S. Reeves, Esq.; George MacDowell, F. T. C. D.; Rev. Joseph A. Galbraith, F. T. C. D.; William Andrews, Esq.

The Society then adjourned till 8 o'clock.

ADJOURNED ANNIVERSARY MEETING.

The President in the Chair.

The Rev. Samuel Haughton (President) proceeded to deliver the following

ANNUAL ADDRESS.

Gentlemen,—Since I last addressed you from this chair, a year of unusual scientific activity has passed, during which a large number of papers of more than usual interest have been communicated to the world by means of this Society. In a city like Dublin, possessed of so many aids to scientific research, a healthy competition exists among the various scientific societies; and I think I may congratulate the members of the Geological Society on the fact that we have not lagged behind in the race during the past year. We have had read before us during that period eighteen geological papers of more or less interest, but all possessing some feature of original thought or research that renders them worthy of preservation in the pages of our Journal. It would be impossible for me to do justice to all in so large a number; but I shall endeavour to bring out some of the more important features of a few, referring you for details to the papers themselves, or to your recollection of them, as read before us. The following list contains the titles of these papers:—Descriptive Geology and Palæontology; 1. Sir Richard Griffith, "On the Stratigraphical Divisions of the Irish Carboniferous Series, as exhibited in the local tables, prepared according to fossiliferous arrangement, in reference to the Geological Map of Ireland;" 2. Mr. William H. Baily, "On Cory-

nepteris, a new generic form of fossil fern;" 3. Mr. John Kelly, "On the Greywacke Rocks of Ireland, as compared with those of England;" 4. Messrs. Brownrigge and Cooke, "On the Geology of the Coast of the County of Waterford;" 5. Mr. Stanley, "On Faults in the Drift of the Central Counties of Ireland;" 6. Professor Jukes, "Geological Notes of a Tour in Switzerland;" 7. Dr. J. R. Kinahan, "On the Zoological Affinities of the Genus Oldhamia;" 8. The President, "On a new Fossil Plant from the Yellow Sandstone of the County of Donegal." Physical Geology and Mineralogy:—1. Mr. Robert H. Scott, "On a new Metallic Ore from the Connorree Mines, County of Wicklow;" 2. Mr. Alphonse Gages, "On the formation of Orpiment in a mass of Sulphate of Barytes, near Silvermines, County of Tipperary;" 3. Mr. A. B. Wynne, "On the Mining District of Silvermines, County of Tipperary;" 4. Dr. Aquilla Smith, "On the Pyrognostic Characters of Minerals, with a new arrangement of those usually found in Ireland;" 5. Mr. George M'Dowell, "On the Wolfhill and Modubeagh Collieries, Queen's County;" 6. The President, "On the Mineral Resources of the Estate of the Provost of Trinity College, near Maum, County of Galway;" 7. Dr. Apjohn, "On two associated Minerals from Ross Hill, on the northern shore of Lough Corrib;" 8. Mr. Patrick Ganly, "On the Past Intensity of Sunlight, as indicated by Geological Phenomena;" 9. Mr. Mahon, "On the Qualifications and Duties of the Mineral Agent;" 10. The President, "On the occurrence of Oligoclase in the County of Donegal."

I believe it would be difficult to overrate the value of Sir Richard Griffith's important paper, either in a scientific or historical point of view. It records with minute precision the fossils, the identification of which by M'Coy formed the basis on which the Geological Map of Ireland was founded, and it possesses a high value as a record of the state of Irish Palæontology at the time at which it was written—a value which, in my opinion, is only second to that which it must always have from its own intrinsic merit, and from the labour and intelligence bestowed upon it. Of Mr. Kelly's paper "On the Greywacke Rocks of Ireland and England," I would observe that it is essentially a criticism of the Silurian system of Murchison, from an Irish point of view. Its ability and vigour do credit to its author, and constitute a merit which must be recognised even by those who differ from the conclusions deduced by Mr. Kelly from his comparison of the Irish and English Silurian rocks. It is known to you that some difference of opinion existed as to the publication of this paper, on the ground that it was a geological heresy to differ in opinion with the distinguished inventor of the Silurian System. The Council of the Society thought it best to allow Mr. Kelly's paper to be printed, inasmuch as the author of a paper alone can be considered responsible for the statements made and inferences drawn in it; and, under those circumstances, neither the Council nor the Society itself could be considered as adopting Mr. Kelly's views. Those views must stand or fall on their own merits; and, for my own part, I must confess that, though I differ from him, I believe his paper, by the free spirit of inquiry which pervades it, and the vigour with which it is

written, does him no discredit, and is worthy of a place in the "Journal of the Geological Society of Dublin." One of the most striking features of the labours of our Society during the past year is the number of papers bearing on the development of the mineral resources of Ireland which have been laid before us. Of the eighteen papers I have before alluded to, no less than seven relate to mining districts or mining operations in various parts of the country. This fact appears to me to give us an additional claim on the support of our countrymen, as it shows we are as ready to turn our attention to the practical applications as to the theoretical speculations of the science we profess to cultivate. The most important of these mining papers is that laid before us by Mr. Mahon, who is already favourably known by his publications on the mines of Wicklow. It contains much information, partly original, and never before published, and partly concisely compiled from the newest and most authentic sources. It is the intention of the Council to print the first portion of this paper in our Journal, and also to publish it, with its valuable appendices, in a separate form, so as to make it known as widely as possible among those interested in developing in a legitimate manner the mineral wealth of the country. At our December meeting, Dr. Apjohn laid before us a highly interesting description of a mineral found associated with metallic ores at Rosshill, county of Galway. He believes it to be Damourite, now for the first time described as occurring in Ireland, and, like the original mineral of Delesse, associated with Andalusite, or Kyanite. Dr. Apjohn's account of this mineral is a veritable monograph, and will form a most interesting addition to our Journal. Mr. A. B. Wynne, of the Geological Survey, has contributed to our proceedings an excellent account of a mining district, that of Silvermines, county of Tipperary, which I can state, from personal knowledge of the district, to be exceedingly accurate and carefully drawn up. He has also illustrated it by a map of his own execution, which reflects much credit upon his skill as a draughtsman. Mr. Gages has taken occasion, from the occurrence of orpiment in a mass of sulphate of barytes, from the same mining locality, to bring under our notice one of his numerous interesting and original experiments, which throws some light on the obscure problem of the mode of formation of the various contents of our mineral veins. His experiments on this subject have been published in our Journal. Mr. Robert H. Scott has analysed, and brought before us, a mineral ore, occurring at Connorree mines, under circumstances similar to those under which a similar ore, described by Dr. Apjohn, in 1851, was found at Ballymurtagh mine, on the other side of the Ovoca. These ores, though similar in respect to the occurrence of sulphuret of zinc in both, associated with the protosulphuret of iron, differ with regard to sulphuret of lead, which was found by Dr. Apjohn to be present to a large amount, while it was totally absent from the ore described by Mr. Scott, who considers his mineral to be a mixture of iron Pyrites and the Marmatite of Boussingault. Dr. Aquilla Smith has permitted me to lay before this Society some of his valuable mineralogical notes, founded principally on the pyrognostic classification and properties of minerals. The first part

of these notes has been already laid before you, but I hope before the next anniversary meeting to be able to complete the series, which will form one of the most valuable and important additions to mineralogical science ever made in this country. I would take this opportunity of expressing, in the name of the Society, the obligations we are under to him for having permitted us to be the medium of communicating his mineralogical and pyrognostic ideas to the world. Mr. Baily's paper on a new genus of fossil fern, from the coal-measures of Glin, county of Limerick, with its excellent plate, forms an interesting addition to our palæontological papers. Dr. Kinahan has completed his researches on the Oldhamias of Bray Head, by the discovery of additional specimens, in better preservation than those previously found by him, and which enable him to speak with more precision than he was before able to do as to the true zoological relations of these curious fossils. This paper of Dr. Kinahan's has not yet been printed, and in this respect is in the same position as several other valuable communications to the Society. We hope from the unusually satisfactory Report of the Treasurer and Council, as to our financial condition, to be able, during the coming year, to publish all our arrears of printing; but this can only be done with prudence by the exertions of our members in procuring new members, and so increasing the pecuniary resources of our Society. The influx of valuable papers on various subjects of physical and descriptive geology, which has occurred during the past year, is mainly owing to our previous exertions in printing and circulating our Journal, which is now well known in all quarters of Europe and America in which the universal science of geology is studied. Although our connexion with the "Natural History Review" has ceased, yet the advantages we gained by it will be continued to us, as stated in the Report of Council, by the new connexion we have formed with the "Dublin Quarterly Journal of Science." The circulation insured to papers read before the Society in future will be the following:—

1. Members of the Society, ...	150
2. Exchanges with other Scientific Societies, . .	100
3. European and American Libraries, by means of the "Dublin Quarterly Journal of Science," .	150
4. Additional circulation of the "Dublin Quarterly Journal of Science" by sale, ...	100
Total, ...	500

The addition of about fifty to our list of members, which it is not unreasonable to hope for, would leave us in a most satisfactory condition as to our finances, and as to the publication of our Journal, which is the most important end of our existence as a Society. Owing to the liberality of Trinity College, and of our valued member, Dr. Lloyd, we are enabled to dispense with house rent, while the transfer of our Museum to the University has improved and extended the facilities for studying geology

in this city to an extent that could not have been effected by a small Society, struggling to maintain its ground under the threefold burden of house rent, cost of a museum, and the publication of its scientific proceedings. Experience has shown that there is not sufficient zeal for science in Dublin to support a society incumbered with these three objects. The Geological Society of Dublin, by getting rid of the first two burdens, and devoting its whole energies to the single object of publishing rapidly and as fully as possible the papers contributed to its meetings, has succeeded in attaining the respectable position which it now holds, and which it will improve and maintain among the scientific societies of Dublin. We owe the gratifying position we hold partly to the hospitality of Trinity College, and partly to the zeal and activity of our own members. Neither of these causes of prosperity is likely to fail us, and I therefore feel little hesitation in predicting our continued future success.

The Geological Survey of Ireland, under the management of our ex-President and Secretary, Mr. J. B. Jukes, has made considerable progress during the year, "the number of sheets of the one-inch Map, now complete, being 87, out of the 205 into which Ireland is divided. Explanatory descriptions of 26 of these sheets have been published, and several more are in the press. There have been also published 8 sheets of longitudinal sections, three cutting across the Queen's County and Kilkenny coal-fields, two across the anticlinals and synclinals of the county of Cork, and one containing a section from Cork harbour over the Galtees, and across the great Slieve-na-Muck fault of 4,000 feet (the grandest proved fault in the world), and connecting Cork with the Limerick district; also two sections across the singular trappean basin of the county of Limerick, with the Ballyhood coal-measures in its centre, and regular bands of bedded trap and limestone coming out all round, with intrusive bosses, and the old pipes and funnels outside that again."

Among the labours of members of our Socity, I would also mention the valuable "Analytical Report on the Metallic Ores of Southern India, exhibited at Madras in 1859," by Captain C. P. Molony, of the Madras Army, published in Madras in 1860. It contains a considerable amount of valuable information, not previously collected, as to the iron and lead ores of Southern India, which there can be no doubt, under proper management, would prove highly remunerative to skilled capitalists.

In a paper read before you in January last, I have placed on record the occurrence of oligoclase felspar, found by me in the syenite of Horn Head, county of Donegal. This syenite is composed of Oligoclase and Hornblende, and forms an interesting addition to our list of Irish rocks. On that occasion I made some observations on the manner in which oligoclase occurs in the granites of Sweden and Norway, in contact with quartz, and sometimes containing particles and veins of this quartz imbedded in its very substance. This appears to me to be a strong reason, in addition to those which I laid before you in my last Address, against considering granite to be simply an igneous rock, the product of fusion or dry heat. If such were the case, it would be impossible to explain why Oligoclase, melted in presence of molten silica, should not pass at

once into the condition of Orthoclase; and indeed, from the limited knowledge I possess of the subject, I am disposed to believe that Orthoclase and Albite, in granite, indicate a higher temperature and more perfect fusion than Oligoclase does. I had intended to have laid before you on this occasion my views in detail on the subject of the origin of granite; but defer doing so until I have completed the investigations I have entered upon with regard to the igneous rocks of the Mourne Mountains. I hope on a future occasion to explain my ideas on this subject, and shall now ask your attention for a short time to a theory of configuration of land and water, and of the mountain chains and ocean valleys of the globe, that has appeared to me for some time to possess much probability and verisimilitude. I have frequently expressed the opinion that the changes of the globe consequent on its original fluidity had but little influence on geological phenomena. These astronomical changes of the globe, resulting from its secular cooling, determined the form and conditions of its seas and lands, long before it was fit for the habitation of any living creature; and I believe that the traces of this original crumpling of the earth's surface are still to be found in the distribution of its mountain chains and sea valleys. As the earth's surface cooled, it contracted upon the liquid interior, by the reaction of which, being incompressible, it was ultimately rent into certain fissures, elevated above the general surface, through which flowed the molten glass that afterwards, when metamorphosed by the action of water, became granite, and subsequently the trappean lavas. These fissures of elevation had a meridional direction, from north to south; and between them lay, as a matter of necessity, deep valleys of depression, into which the aqueous atmosphere of the globe was distilled on cooling. The existence of those meridional lines of fissure or elevation and depression is mathematically demonstrable from the conditions of cooling of a body shaped as the earth is; and these meridional lines of fissures were afterwards succeeded by transverse lines of elevation and depression in each hemisphere, following the line of small circles of latitude. Let us examine briefly, from this point of view, the structure of the present surface of the globe. Two irregularly-shaped valleys, but on the whole following a meridional course, traverse the surface of the earth from pole to pole. One of these, the Atlantic valley, passes close along the east coast of Greenland, between that country and Iceland, and thence extends southward on the meridian of 20° W. to the South pole itself. This valley is divided in the North Atlantic by the "middle ground," containing the Azores, into two valleys, of which the western, though less straight, is somewhat the deeper of the two; while in the South Atlantic its course is more directly southern, and, from the little we know of it, both by soundings and tidal observations, it appears to be considerably deeper than in the North Atlantic. The second meridional valley, starting from the south, keeps along the west coast of South America, in the meridian of 90° West, in a direction due south and north, in very deep water, so far as we can infer from the progress of

the tidal wave. Having reached the equator, it is directed to the west of north along the coast of North America, and enters the polar basin through Behring's Straits, in the meridian of 170° W. These two great meridional valleys divide the globe into two lunes, one containing the continents of the Americas and Greenland, and the other containing the Great continent, Africa, Australia, and the large islands north of it.

These two portions of the earth's surface appear to me to have had their equilibrium destroyed by meridional fractures in a manner precisely similar, but inverted with regard to the northern and southern hemispheres in the two cases. Each lune of the globe may be regarded as an arch, having for buttresses the meridional lines of depression already noticed. These buttresses having given way, the whole arch has broken, but in a different manner in the northern and southern halves. An arch, or dome, may give way when its buttresses fail, either by the bursting up of the crown and falling in of the hips, or by the falling in of the crown and bursting up of the hips of the arch. Both these cases have occurred, as I conceive, in each of the two great divisions into which the meridional valleys divide the globe.

1. The Great Continent.—In the northern hemisphere this mass is bisected by the meridional chain (60° to 75° E.), extending from 7° N. to 77° N., containing the western Ghauts, the Bolor and Solimaun Ranges, the Ural Mountains, and Nova Zembla, through a distance of 4,200 geographical miles. This ridge of elevation I suppose to represent the bursting up of the crown of the arch. In the southern hemisphere, however, the other form of fracture has occurred. The crown of the arch has fallen in, as shown by the deep valley of the Indian Ocean lying between Africa and Australia,—a valley the depth of which, as indicated by the progress of the tidal wave, is comparable with that of the South Atlantic. On either side of this central valley the hips of the arch have burst up in the meridians of the Cape of Good Hope and Van Dieman's Land, forming the meridian chains of mountains of Africa and Australia. These meridional chains are nearly symmetrically situated with respect to the crown of the northern arch or meridian of Cape Comorin, that of the Cape of Good Hope lying 60° W., and that of the eastern meridional chain of Australia 65° to the east of the meridian. In the northern hemisphere a secondary fracture has taken place, which I shall presently consider, and which modifies the primary or meridional fracture.

2. The American Continents.—In America the southern arch of the lune has burst up its crown along the meridian of Cape Horn, forming the great chain of the Andes, which extends north and south for 3,900 geographical miles, and is in every respect the counterpart of the Ural and Solimaun chain of Asia. In the northern hemisphere, however, the other mode of fracture has taken place, the crown of the arch having fallen in, forming the depression occupied by Baffin's Bay, Hudson's Bay, and the central lowlands of North America; while the haunches of the arch have burst up along the line of the Rocky Mountains and the chain of Greenland and the Alleghany Mountains. We have thus the two

great masses of land on the globe constructed by the original fracture on the same plan, but reversed with regard to hemispheres, of the lunes of the globe in which they are placed.

The primary meridional fractures having occurred, the secondary fractures are to be explained on the principles of the equilibrium of a dome, and not of an arch. I regard the whole northern hemisphere as one dome, and the southern as another. In the northern hemisphere the centre of the dome has fallen in, forming a depression at the pole, or Arctic Basin, and the hips of the dome have burst up along the small circles of latitude lying between 35° and 46°. In the great continent this up-burst of the dome may be traced from the Pyrenees, through the Alps, Balkan, Anti-Taurus, Caucasus, El Burz, Hindoo Koosh, the Thian Shan, and Shan Garjan Mountains, to the city of Pekin, through a range of 150° of long., or 6,700 miles in length. This astonishing range of mountains continues with but little deviation along the parallel of 40° N., forming a striking contrast to the meridional chains which traverse great circles of the globe. It is also a very remarkable fact that the Snowy Mountains of North America (700 miles in length), which form the only east and west range in that continent, are found to run along the parallel of 41° N., which we have every reason to believe resulted from the simple mechanical principles influencing the fracture of the northern dome; and even in the bed of the Atlantic a shallow band (the proposed line of the French telegraph) crosses the ocean in the same parallel from the Newfoundland bank to the Pyrenees. In the Southern Hemisphere, on the contrary, the equilibrium of the dome has given way by the reversed process—the crown having burst up, forming the Antarctic Continent, and, the hips of the dome having sunk in, form the small circle of deep water 40° S., which is interrupted only twice; by New Zealand, and the southern prolongation of the Andes.

I do not mean to assert that the present valleys and lines of elevation were those of depression and elevation of the primeval crystal glass of the fractured crust of the original globe; but I do believe that the lines I have pointed out were originally, and have always been, lines of either elevation or depression, and have constituted alternately the axes of continents or the valleys of the ocean. In a flat-arched dome, like the crust of the earth, very slight modifications of external conditions would convert the lines of depression into lines of elevation, and *vice versâ*; and though the limits of this Address do not permit me to enter into detail on this subject, I think sound geological reasons could be adduced in support of the views I have advanced, which are based simply on mechanical reasonings. Although we have good geological reasons for supposing that the present line of elevation in the parallel of 40° N. latitude took place during the period preceding the tertiary, yet there is abundant evidence to show that it took place along the line of an ancient fissure, through which was poured the granite glass, considered by M. Durocher as the outer solidified layer of our globe. A specimen of the granite of Mount Blanc, taken by one of our members, Mr. Robert Reeves,

from a peak only 500 feet below the summit, gave me the following composition:—

Silica,	72·96
Alumina,	14·00
Peroxide of Iron,	2·42
Lime,	1·12
Magnesia,	0·14
Protoxide of Iron,	0·38
Protoxide of Manganese,	0·40
Soda,	4·33
Potash,	4·47
	100·22

This granite is identical in composition with that of Leinster, or with the type granite of Durocher, forming the outward layer of the earth's crust, and was probably poured out along the line it now occupies ages before the tertiary period. The mention of this granite reminds me of a sacred debt we owe to Durocher, whose untimely death was announced to us at the same meeting at which we elected him one of our honorary members. He was best known to us by his brilliant though brief essay on Petrology, of which it has been well said that if it was a romance, it was that of a man of genius. Truly the dreams of such men are of more value than the waking thoughts of many who lead scientific opinion among us. Durocher was educated at the Polytechnic School, and having become an Engineer of Roads, Bridges, and Mines in the public service of France, ultimately was appointed Professor of the Faculty of Science at Rennes. He was devoted to the study of physical geology, and possessed most of those high qualities which have made his country and his countrymen, in politics the terror, and in science the admiration, of Europe. Ambitious and ardent in pursuit of his favourite study, he overworked himself, and his premature death has added another name to the too-long list of those whom the world has lost too soon. It is creditable to this city and college that his labours were early appreciated in it. His work on Comparative Petrology has formed for some years a portion of our course for Honors in Trinity College; and I have been informed by my friend Professor Sullivan that at the time the translation of Durocher's Petrology was published by M'Glashan and Gill, of this city, he had himself nearly completed a translation of the same work, intended for publication in the "Atlantis."

MINUTES OF PROCEEDINGS OR THE YEAR 1860-61.

General Meeting, November 14, 1861.

The President in the Chair.

The Minutes of the last meeting having having been read and confirmed, donations announced, and thanks voted, the following gentlemen were elected Members of the Society:—

Bindon Stoney, Esq., C.E., 89, Waterloo-road; W. Gillespie, Esq., 24, Upper Merrion-street; Lord Dunally, Kilboy, Nenagh, Life Member; John Barton, Esq., Stone House, Donnybrook; Francis Lisabe, Esq., C. E., 42, Upper Sackville-street.

The following gentlemen were also elected, as Associate Members, for the Session 1860-61:—

De Burgh Persse, Esq., 19, Trinity College; James M'Dowell, Esq., Model Farm, Glasnevin; J. Glennan, Esq., Dolphin's-barn; M. Wilkinson, Esq., 180, Brunswick-street; G. Smith, Esq., 9, Trinity College; R. Hassard, Esq., 13, Pleasant-street; J. Lyster, Esq., 37, Trinity College; B. Traill, Esq., 4, Montpelier-parade; E. W. Doyle, Esq., 5, Martello-terrace; C. W. Bateman, Esq., 56, Camden-street; J. M. Scott, Esq., Ballygannon; George Leeson, Esq., 1, Grantham-street; William Knapp, Esq., 6, Belgrave-square; William Gibbon, Esq., Cottage, Sandymount; William Robinson, Esq., 20, Holles-street; Henry M. Hart, Esq., 25, College.

Mr. Jukes then read his paper, entitled "Geological Notes of a Trip in Switzerland." A discussion ensued, in which the President and Dr. Sidney took part.

The Society then adjourned.

General Meeting, December 12, 1860.

The President in the Chair.

The Minutes of last Meeting having been read and confirmed, donations announced, and thanks voted, the following gentlemen were elected Members of the Society:—

E. Hutton, M. D., 5, Merrion-square; W. B. Brownrigg, Esq., 18, Adelaide-road; E. E. Barrington, Esq., Fassaroe, Bray.

The following gentlemen were elected as Associate Members:—

J. M'Grorty, Esq., St. Andrew-street; J. G. Birch, Esq., 2, Adelaide-terrace; J. Crosthwaite, Esq., 17, Trinity College; H. Grubb, Esq., 15, Leinster-square; J. Jameson, Esq., Portmarnock, Malahide; B. G. Patterson, Esq., 1, Sandford-place; R. Ball, Esq., 2, Granby-row.

R. Mallet, Esq., C.E., presented to the Society a specimen of Lithomarge from Rathlin Island, which, ground with lime and sand, with or without calcination, makes good hydraulic mortar, and which is found also in the north cliffs of Antrim; also a specimen of Oolitic Limestone, from Morgue Quarry, Ballina, found *in situ*.

Dr. Kinahan read his paper, entitled "Notice on the Genus Oldhamia." A discussion ensued, in which the President, Dr. Wright, and Mr. Jukes took part.

Dr. Apjohn read his paper "On two associated Minerals from Ross Hill, on the northern shore of Lough Corrib."

The President made some remarks.

The President read his paper "On some Fossil Plants recently discovered by W. Harte, Esq., C.E., at Darney, County of Donegal."

The Secretary read Mr. G. C. Mahon's paper, entitled "Hints for a Mineral Agent."

Mr. Jukes proposed, and Mr. Mallet seconded the motion, "That Mr. Mahon be requested to allow his paper to be printed in the Journal of the Society."

The Society then adjourned.

GENERAL MEETING, JANUARY, 9TH 1861.

THE PRESIDENT in the Chair.

Minutes of last meeting read and confirmed, donations announced, and thanks voted.
The President read a letter from Lieutenant W. H. Noble, R. A., presenting to the Society a specimen of a Cylindrical Tube of Ironstone, found by him in the Isle of Wight.
Mr. A. H. Jacob, 1, Brighton-avenne, Monkstown, was elected an Associate Member.

The President then read the proposition of the Council, of the 19th Decemher, that the following gentlemen be proposed as Honorary Members of the Society:—

M. Daubrée, Strasburg; M. Delesse, Ingenieur des Mines, Paris; M. Charles Deville, Paris; M. St. Claire Deville, Paris; M. Durocher, Rennes; M. H. B. Geinitz, Dresden; M. L. De Köninck, Liege; M. Marcel de Serres, Montpelier; and they were elected by acclamation.

Mr. Ganly read his paper "On the Past Intensity of Sun-light, as indicated by Geological Phenomena." A discussion ensued, in which the President, Dr. Carte, and Mr. M'Causlan,d joined.
Mr. Jukes then took the Chair, while the President read his paper "on the Occurrence of Oligoclase in the County Donegal."
The Society then adjourned.

ANNUAL GENERAL MEETING, FEBRUARY 6, 1861.

The Society met at 2 o'clock, the PRESIDENT in the Chair.

The ballot was declared open. The Minutes of last meeting were read and confirmed; the abstract of Treasurer's Account for 1860, and the Report of Council, were read and adopted.
The President proposed to the Society that Captain Sir Leopold M'Clintock be elected an Honorary Member of the Society, in consequence of the services rendered by him to the science of Geology during his four arctic voyages.
The ballot was declared closed. M. Gages and Mr. Kelly were appointed Scrutineers, and the following gentlemen were declared unanimously elected the Officers and Couucil for the ensuing year (*vide* page 211).
The Society then adjourned till 8 o'clock.

ADJOURNED ANNIVERSARY MEETING, FEBRUARY 6, 1861.

The PRESIDENT in the Chair.

The Secretary presented a fine specimen of Ripple-marked Sandstone from the County Limerick, being a donation from B. D. Gibbons, Esq., Engineer to Kingstown Harbour.
The President then read his Address.
Professor Jukes then moved, and Mr. Callwell seconded, the proposal that the Address be printed.
The Society then adjourned.

X.—On the Blowpipe, its History and Use. By Aquilla Smith, M.D., Vice-President of the King and Queen's College of Physicians in Ireland.

[Read June 13, 1860.]

The Blowpipe is an instrument by means of which the flame of a lamp or candle may be concentrated, so as to communicate a very intense heat to small bodies placed within the flame. Although this instrument was employed in the arts by the ancient Egyptians about 1500 years before our era, and in more modern times has been used for various purposes, particularly by goldsmiths and jewellers in the soldering of metals on a small scale (whence it derives its name in the German language, "Löthrohr," from "Löthen" to solder, and "rohr" a tube or pipe), it is scarcely more than a century since the idea of applying it to mineralogical purposes was conceived.

The accompanying woodcut is taken from Rosellini, and represents an Egyptian silversmith using the Blowpipe. It was found in a Theban tomb, in conjunction with representations of workers of gold.

The following description of this remarkable figure is given by Rosellini:—

"L'artefice sta seduto dinnanzi ad un fornello posto in una vasa di terra, nel quale, mentre soffia con un tubo di canna armato in cima di metallo per difesa dal fuoco, sembra prendere o aggiustar colle môlle la materia che fonde, o che arroventa. A' suoi pede è figurato un mucchio che par d' argilla, della quale usano i fondatori de' metalli, o per forme, o per altre bisogne dell' arte loro."—*Rosellini. I Monumenti dell' Egitto e della Nubia. Parte seconda. Monumenti Civili.*—Tom. ii., p. 292; Tavola lii., fig. 4.

Bergmann informs us that, about the year 1738, Andrew Swab, a Swedish metallurgist, and Counsellor of the College of Mines, was the first to employ this simple and elegant instrument for the purpose of

assaying metallic minerals. He, however, left no work on the subject, and it is unknown to what extent his researches with this instrument were carried. The subject does not appear to have received any particular attention from any one until Cronstedt, a Swedish nobleman, in 1758, proposed his system of mineralogy, in which the arrangement is dependent on the chemical composition of the minerals. In order to recommend the general adoption of his system, it became to him a matter of great importance to possess some ready and simple means of determining the constituents of mineral bodies, as it was evident that the slow and laborious operations of chemical analysis could not be generally employed by mineralogists. He found the object of his pursuit in the Blowpipe; and by the employment of fluxes in the experiments performed with this instrument, he may be considered as the founder of a new mode of investigation in chemical science. He used the Blowpipe to distinguish mineral substances from one another, by the means of fusible reagents, whose actions should produce such modifications on the objects to which they were applied as might afford some conclusions respecting their composition, and serve as a basis for the classification he adopted. He carried the use of the Blowpipe to a degree of perfection that could only have resulted from the most persevering industry. The results obtained by him are to be found in the first edition of his "System of Mineralogy," published in Sweden, in 1758, a translation of which into English, by his pupil, G. von Engeström, was published in 1765. The last edition is that by J. H. de Magellan, 2 vols., 1788.

The employment of the Blowpipe, being thus brought into notice, excited the attention of chemists and mineralogists to the use of the instrument, who, however, derived little advantage from it, except as a means of ascertaining the fusibility of bodies, and occasionally their solubility in borax; for the want of skill in its application, which can only be acquired by patience and practice, prevented a just estimate of its value being formed.

In Sweden, however, it appears to have been cultivated with the greatest success; and it is to the chemists and mineralogists of that country that we are indebted for the greater portion of the information we possess on this subject, particularly to Bergmann, Gahn, and above all to Berzelius.

Bergmann extended the use of the Blowpipe by a series of original researches, in which he investigated the properties of most of the then known species of minerals, and applied it to the field of inorganic chemistry, in discovering very minute portions of metallic matter in analytic researches; and published the result of his observations at Vienna, in 1779, in a treatise under the following title: "De Tubo Ferruminatorio, ejusdemque usu in explorandis Corporibus, præsertim Mineralibus;" a translation of which into English will be found in the 2nd vol. of Bergmann's Physical and Chemical Essays, by Dr. Edmund Cullen, Lond., 1788.

The close and continued application which Bergmann bestowed on his studies had such an effect on his health, as to oblige him to continue his

philosophical pursuits with the help of an assistant. He accordingly employed Assessor Gahn, who performed, under his directions, a series of operations on all the minerals then known, by which he was taught in what manner each individual conducted itself before the Blowpipe. The experience thus acquired enabled Gahn to employ the instrument in every kind of chemical and mineralogical inquiry; and he attained such a degree of skill in its use, that he could detect the presence of substances in a body by its means, which had escaped the most careful analysis, conducted by the ablest chemists of those times. Gahn was indefatigable in his observations and experiments with the Blowpipe, without which he never travelled; and though he was led to contrive several improvements in its application, which were imagined and executed with such sagacity and precision that his results were entitled to the greatest confidence,—he appears never to have thought of publishing an account of his labours, which no doubt would have been of great importance.

As an instance of his power of detecting the presence of metallic bodies, we are told by Berzelius that he had often seen him extract from the ashes of a quarter of a sheet of paper distinct particles of metallic copper, and that too before the knowledge of the occurrence of this metal in vegetables was known, and therefore before he could have been led from this circumstance to suspect its presence in paper.

Although we cannot but feel regret at having received no work from a man so eminently qualified to instruct on this subject as Gahn, still we must consider it fortunate, that, under such circumstances, the knowledge and experience of so long and laborious a life has not altogether been lost. Fortunately for science, accident, as it were, made Berzelius the medium through which this information was to be communicated to the world, and it must be universally felt and acknowledged that he has most ably fulfilled the task assigned to him. The zeal and assiduity of Gahn in this study, together with the circumstances to which we are indebted for the preservation of his labours, are told in an interesting manner by Berzelius, in his treatise on the Blowpipe.

Such, then, is the origin of Berzelius' treatise, a work which has been acknowledged as the highest authority on this subject by almost every writer on mineralogy, for the last 20 years. An English translation of the French edition, by M. Fresnel, was published by Mr. Children in 1822.

We have now given as full an account of the rise and progress of the Blowpipe, in its application to mineralogy, as the nature of the subject will admit; and before we conclude this part of our subject, we feel called on to show that the use of this valuable little instrument was not as much neglected in England as we might be led to suppose from an assertion made by Berzelius, at the close of his history of the Blowpipe:—"In all the rest of Europe only one naturalist, but he a very distinguished one, has applied himself to the study of the Blowpipe and its uses, and submitted a large number of mineral substances to its test: this was H. de Saussure." Some years previous to the publication of Berzelius' work, Mr. Arthur Aikin, the author of a Manual of Mineralogy, the second

edition of which was published in London in 1815, had arranged all mineral substances according to their habitudes before the Blowpipe, yet it must be admitted that it was applied by him in a limited manner; for in many instances he only states the degree of fusibility of the mineral, and occasionally its colour after fusion, rarely noticing the minute details which are so useful, as in many instances offering most satisfactory characteristics, particularly when the aggregate of the characters are taken into consideration. And although Dr. Wollaston has never communicated his knowledge on this subject to the world, it is well known that he was eminently distinguished for his dexterity in managing this useful little instrument; and in later times Mr. Children and the late Dr. Turner made many important discoveries respecting the use of re-agents with the Blowpipe.

I.—Description of the Blowpipe.

Blowpipes are of two kinds, *simple* and *compound*. A simple Blowpipe consists merely of a conical tube, generally made of metal, through which air is blown from the mouth of the operator. A compound Blowpipe consists of a tube through which common air or gas of some kind is blown by some secondary apparatus, to which the tube is attached.

As our object is to simplify, as much as possible, the application of the Blowpipe to the purposes of the practical mineralogist, we shall only describe the one we have found to answer best, and for the descriptions of the various kinds, both simple and compound, refer to the work of Berzelius, or the useful little manual "on the Use of the Blowpipe," published by Mr. Griffin of Glasgow.

The instrument we have always used is that invented by Dr. Wollaston; it is made of copper, and consists of three pieces, two of which, when united, form the tube, about seven inches in length, the widest extremity of which constitutes the mouth-piece, and is plated, to prevent the disagreeable taste which copper would produce in the mouth of the operator. The third part, or nozzle, which when fitted on the smaller end of the tube forms a right angle with it, is sometimes constructed so as to form an oblique angle with the tube, which, in our opinion, is not as convenient as the former. The nozzle is also sometimes made of platina. We have, however, used one of brass for some years, and it is as good now as when first it was made.

This instrument is very light, so that the operator can, when occasion requires, hold it steadily between his teeth while blowing, and enjoy the use of both his hands for a time, and for portability it far exceeds all others; for when the instrument is not in use, the nozzle fits into the open extremity of the second piece, and the latter within the mouth-piece; in this form its length is reduced to less than four inches, and it occupies no more room than a pocket pencil-case. One inconvenience attends the use of this instrument, that is, the condensation of the vapour of the breath in the interior of the tube; and contrivances have been made to obviate this, by attaching a hollow chamber to some part

of the tube to collect the condensed vapour. In our opinion, this trifling objection, which can at all times be readily removed by inverting the tube or blowing forcibly through it, is not at all compensated for by the addition of the chamber, which adds considerably to the weight of the instrument.

II.—The Combustible or Flame.

A great diversity of opinion exists respecting the material which should be used to produce the flame for the Blowpipe: wax, oil, and tallow have been recommended; we have always preferred a candle made of pure wax, about an inch in diameter, with the wick rather thick in proportion to the size of the candle; it is far more cleanly than tallow or oil, burns with a clear flame, does not emit any disagreeable odour, and affords a heat sufficiently intense. The candle should never be more than about six inches in length; and we have found advantage in using a supporter made of tin plate, to the socket of which is attached a stem about three inches long, which is made to slide in a tube of the same length, attached to the foot of the supporter. By means of the sliding socket, the flame of the candle can always be kept at nearly the same elevation from the table, at a height most convenient to the operator.

III.—Method of Blowing.

The operation of keeping up a continued and steady stream of air through the Blowpipe, simple as it seems, is difficult at first; the whole artifice, however, consists in this, that while the operator breathes through his nostrils, he must blow the air contained in his mouth by the mere compression of the cheeks; to accomplish which, the first thing to be done is to acquire the habit of breathing easily, and without fatigue, through the nostrils alone, while the mouth is filled and the cheeks inflated with air; when this is acquired, the Blowpipe may be put into the mouth, and the confined air expelled through the tube by means of the muscles of the cheek. As soon as the air is nearly exhausted, the expiration from the lungs, instead of being made entirely through the nostrils, is to be partly forced into the cavity of the mouth: all subsequent supplies of air are to be introduced in the same manner as the first. Thus, with a little practice, the power may be obtained of keeping up a continued blast for as many minutes as may be necessary for any ordinary operation.*

IV.—Of the Blast and Flame.

Having accomplished the first object of keeping up a steady blast, the next requisite is to produce a good heat: this is best attained by keeping

* It is generally supposed that it is a matter of some difficulty to use the Blowpipe—that it requires great pulmonary exertion, and may on this account be injurious to the health. Such, however, is not the case, as the experience of half an hour will convince any person, under the direction of a skilful teacher.

the wick of the candle of a moderate length, and avoiding all drafts or currents of air, which would render the flame unsteady. The point of the Blowpipe should be held just above the wick; and as soon as the blast is directed on the flame it will be observed to assume a conical form, and to consist of two parts, an outer and inner, the latter of a light blue colour, converging to a point at the distance of about an inch from the nozzle; the former of a yellowish colour, and converging less perfectly. The most intense heat will be just at the point of the inner flame.

To attain the maximum degree of heat, we must neither blow too strongly nor too gently; and we should bear in mind that our pyrognostic operations are not confined to obtaining the highest possible temperature; other phenomena must be produced, which require a less intense heat. A very important point in pyrognostic assays is the power of producing at will the phenomena of oxidation and reduction, both of which are easily effected, although diametrically the reverse of one another.

1. *Oxidation.*— Oxidation goes on most actively at an incipient red heat; and the further we recede from the flame, the better the oxidation is effected, provided we can keep up a sufficient heat. The opening in the nozzle of the Blowpipe, we are told, should be larger for this operation than in other cases: however, we have always succeeded with the ordinary nozzle we use for all purposes; and which in this case answers very well, by holding it a little further from the flame.

2. *Reduction.*—Reduction or de-oxidation is best effected in the brilliant part of the flame, immediately beyond the point of the inner blue flame, and it requires more expertness in the operator than the very simple process of oxidation. A very good mode of acquiring the art of making a good reducing flame is to fuse a small portion of tin on a piece of charcoal, so that its surface may always retain its metallic brilliancy: tin has so great a tendency to oxidation, that the moment the flame begins to become an oxidating one, it is converted into an oxide of tin, which covers the metal with an infusible crust.

V.—Of the Support.

The assay, or substance to be examined by the Blowpipe, must necessarily rest on a solid body, or be fixed in a steady position by some means; and the material or instrument by which this is effected, is called the Support, of which there are two kinds, the combustible and incombustible.

1. *Combustible Supports.* The combustible support generally used is charcoal, and that prepared from the light woods in general answers best; and as it is not always easy to obtain charcoal which possesses all the qualities, which it should possess, we shall detail the manner of preparing such as we have found to answer very well.

Take pieces of white pine-wood of a fine grain and free from knots, about six inches in length, and an inch or more square; place them in a

large common crucible, and cover them with fine sand; then place the crucible in the centre of a strong fire, and leave it there until the wood is perfectly charred, which will take place in about an hour. The crucible should then be removed from the fire, and allowed to cool slowly; and when cold, the charcoal will be ready for use. When well prepared, it should be perfectly black, very light, possess some lustre, and be easily broken across the grain; that which splits, scintillates, smokes, or emits flame when heated, is not of good quality.

Mr. Children recommends alder wood, as possessing all the necessary qualities to make good charcoal.

Charcoal is chiefly used in the examination of the metallic ores when our object is to reduce them, because it attracts the oxygen from the oxide, and thereby accelerates reduction to the metallic form. The intensity of the heat may be greatly increased by making a cavity for the assay in the charcoal, and covering it with another piece of charcoal, which by reverberating the heat converts it into a reverberating furnace of great intensity.

Gahn* directs that a small hole should be made in the charcoal, and into this hole the substance to be examined must be put. The assay should be placed on the side of the charcoal, and not the end; otherwise, the substance to be fused spreads about, and a round bead will not be formed. But Berzelius, in the following passage, gives us directions quite contrary (p. 31):—"In order to fix the flux to a point on the surface of the support, one of the ends perpendicular to the layers of the wood is to be chosen for its receptacle; *if placed on the section parallel to the layers, it would spread over the surface.*" We have occasionally used both methods, but prefer placing the assay on the side of the charcoal; however, a little experience will be the best guide for the experimenter.

2. *Incombustible Supports.—Platinum Wire.* The only incombustible substance used as a support which it is necessary to notice is platina, which, from the difficulty of fusing it even in a very high temperature, its malleability, and property of conducting heat very slowly, render it preferable to any other material.

Platinum Forceps.—One of the greatest advantages of this instrument is, that it enables us to fix the object of experiment in a steady position; and by this means a very minute fragment, which it would be impossible to keep fixed on charcoal, can be examined with great advantage.

The chief advantage of this instrument is that it enables the operator to submit a mere fragment of a mineral to a high and uniform temperature, which could not be effected on charcoal, as the assay would be blown away the moment the jet fron the pipe would be directed on it. Hence we have found several minerals which on charcoal were apparently infusible, yet when placed in the forceps, and submitted to a well-

* *Vide* Thompson's "Annals of Philosophy," vol. xi., p. 40, on the Blowpipe, from a treatise on the Blowpipe by Assessor Gahn, of Fahlun, by Dr. Ure, as Mr. Griffin informs us.

directed flame, fuse without difficulty on the edge; and besides it enables us to observe the effect of the assay on the flame, in producing certain colours which are very characteristic of some minerals, as Carbonate of Strontia and Lepidolite, which tinge the flame red; Cyprine and Boracite, which impart a green colour.

The forceps may be used with advantage in the examination of all the earthy and many of the metallic minerals, particularly such as are refractory on charcoal. We should, however, be careful not to employ it as a support for those metallic oxides and compounds which are reducible *per se* before the Blowpipe, and readily form an alloy with platina.

The forceps are used for holding a small portion of a mineral, when we wish to try its fusibility. The most convenient form of this instrument consists of two thin plates of steel, each having a piece of flattened platina about the sixteenth of an inch wide riveted on its extremity. The platina points should possess as little bulk as possible, in order that little heat may be abstracted. These plates are fastened in the middle to a small piece of iron or brass, somewhat of wedge-shape, so that the platina extremities are held in close apposition by the spring of the steel plates, while the other extremities are separated about a quarter of an inch, and may be used as an ordinary spring forceps. The platina extremities are opened by pressing the fore-finger and thumb against two small buttons, the shank of each of which is fixed in one plate, and passes through the other.

VI.—Additional Instruments.

Under this head we arrange all those instruments which are used for various purposes, subservient to the examination of minerals.

1. *The Common Steel Cutting Pliers*—Is very useful for detaching small portions from a specimen, without the risk of injuring it by the concussion which would be caused by a hammer.

2. *A small Jeweller's Hammer*—Is also useful for detaching fragments for examination from specimens, and for ascertaining the malleability of the globules obtained from metallic minerals.

3. *A small Anvil*—Is used for crushing pieces of minerals, which are to be wrapped in paper, in order to prevent the dispersion of the fragments, and also for trying the malleability of metals. We have preferred a small smoothing-iron, the face of which has become *black* by oxidation, the advantage of which will be pointed out hereafter.

4. *A Pocket Knife*—With well-tempered blades, is an indispensable instrument for trying the hardness of minerals, which is estimated by the resistance they oppose to it. It may also be applied for the purpose of mixing a pulverized mineral in the palm of the hand with water or the fluxes.

5. *A Small Triangular File*—Is requisite to test the degree of hardness of such minerals as resist the knife, and also for the purpose of cutting glass tubes, &c.

6. *A Small Agate Mortar and Pestle*—For the purpose of pulveriz-

ing the harder minerals, and separating minute metallic globules from the charcoal on which they have hardened; and a piece of pumice-stone should be at hand, to remove the traces left on the surface of the mortar by the trituration of metallic substances.

7. *A Pocket Microscope*—Containing three glasses of different powers, which may be combined if necessary, is perhaps the most convenient.

VII.—Of the Size of the Assay, and its Preparation for Examination by the Blowpipe.

1. *Size of the Assay.*—The fragment of the substance submitted to the Blowpipe for examination is termed the *Assay*, and it is a matter of the greatest importance in pyrognostic experiments that some definite size for the assay should be agreed on by experimenters. Mr. Mawe tells us that "the piece of mineral to be examined should not in general be larger than a *peppercorn*." Dr. Ure (Chemical Dict., art. Blowpipe) says that "it should not exceed the size of half a peppercorn." Bergmann, however, with whom the specification of this bulk originated, observes "that we must often operate on smaller portions." Von Engeström recommends a piece about the size of a cube one-eighth of an inch on the side. Now, it may be safely asserted, that no correct or extended set of experiments on minerals with the common Blowpipe could be made on pieces nearly so large; and that no person using the Blowpipe for the first time could make any impression on a piece of that size, unless he happened to meet with a very fusible substance. It is probable that many persons (and I have known instances myself) have failed in their attempt to use the Blowpipe, by using an assay of too large a size; for nothing can be more evident, than that if the assay be large, a part of it must necessarily be out of the force of the flame, which is very small, and must therefore tend to cool the part immersed in the flame; the consequence of which is that the heat is carried off, and the operator will be tired before the assay is in the least affected, unless it be very fusible indeed.

Mr. Aikin, who published his Manual of Mineralogy in 1813, was the first who perceived the necessity of operating on pieces of very small bulk; and recommends that the size of the assay "*should scarcely exceed the bulk of a pin's head*," which is perhaps as good a type of the size as could be given.

Berzelius says, "As to the size of the morsel operated on, it is large enough, if we can distinctly see the effects produced on it; and we are more likely to fail in our object by using too large, rather than too small a piece;" and adds, that "a piece of the size of a large grain of mustard-seed is almost always sufficient," and that "the only instance in which it may be convenient to operate on portions larger than a mustard-seed is when we wish to extract metals, because in that case we obtain a larger portion of the metal sought for, which may consequently be examined and distinguished with greater ease."

In the first experiment the assay should never exceed the size assigned by Aikin; for unless we attend particularly to this, we can never arrive at uniform results, or institute comparisons which would be of any value. There are many minerals which, if used the size of a peppercorn, which has been recommended by most authors, would be altogether infusible by the means we adopt, yet a small fragment of the same substance will be fused without any difficulty. When we have ascertained that a mineral is easily fused, it is often desirable to operate on a larger piece in metallic minerals. If we find a fragment infusible in the first attempt, we should select another with a thin edge, and submit it to the most intense heat we can produce; and in this way we sometimes succeed in fusing the thin edge of an assay which, under other circumstances, might be pronounced infusible: in such cases we should always examine the edge of the assay with the microscope. Minerals sometimes occur in very minute grains or pulverulent (as Iserine) which cannot be held in the forceps; and if they cannot be retained on charcoal, the only mode of proceeding then is to reduce them to powder, form the powder into a paste with a little water in the palm of the hand, and then place it on charcoal, when in some cases it will form a cake, which may then be held in the forceps, if necessary.

2. *Preparatory Examination.*—When we are about to enter on the examination of a mineral substance, we do not begin immediately with the Blowpipe: a few very simple preliminary experiments are first to be made, by which the succeeding steps of the examination may be directed.

As it is a matter of some importance to save trouble, and, above all, time, we shall state the manner in which we have been in the habit of proceeding. Our first care should be to select a homogeneous particle, which will be a matter of no difficulty, if the mineral be crystallized; and should it be amorphous, a magnifying glass becomes necessary, to discover any heterogeneous matter, should it exist; for minerals do not always consist of the same substance throughout, although they may appear so to the unassisted eye. Next we ascertain the degree of hardness, by scratching it with a knife; and if it resists this, we resort to the file. We may then try if it be attracted by the magnet, always using a minute fragment for this purpose. The action of muriatic acid should next be resorted to, to ascertain if the mineral effervesces; and it is right to mention, that the effervescence of some of the carbonates will scarcely be visible unless the mineral has been reduced to powder by scratching with a knife, or pulverizing it in an agate mortar, and at the same time we may determine whether it be partly or entirely soluble in the acid. The specific gravity should in every case be taken, if convenient, but in the present stage of our proceeding it is not absolutely necessary.

VIII.—Re-agents used with the Blowpipe.

1. *Borax Flux.**—The borax of commerce sometimes contains impurities: it should be dissolved, and crystallized again, before it is used for experiments with the Blowpipe. It is kept in the state of powder, and is used to effect the solution or fusion of a great number of substances, and on the whole I consider it the most generally useful of all the fluxes.

I have found the following the most convenient mode of using this flux:—A piece of fine platina-wire, about the thickness of strong sewing silk—it should be fine, provided it be thick enough not to bend with the blast; if too thick, it absorbs too much heat—and about three inches in length, is fixed by one end in a piece of glass-rod, which is easily accomplished by fusing the end of the glass, and inserting the end of the wire, which must also be heated; the other extremity of the wire is bent into a hook, about the one-eighth of an inch in diameter. Having moistened the hook with the tongue, it is to be dipped into the powdered borax; the portion which adheres is to be heated with the Blowpipe; at first it swells up, owing to the water of crystallization which it contains, and afterwards fuses into a transparent globule, which adheres to the curved wire; it should then be allowed to cool, to ascertain if it is perfectly colourless; for should it be otherwise, some impurity is present. The globule should never be more than about the eighth of an inch in diameter; for if it is made too large, its weight while in a state of fusion will overcome its attraction to the wire, and cause it to fall off.

Having the assay prepared of a small size, and placed on the anvil, the next step is to fuse the borax again, and, while it is hot, apply it to the assay, which will adhere to it. At this moment, if the assay contain any water or volatile matter, it will be deposited on the cold iron, and if the quantity of water in the mineral is considerable, the vapour will be condensed in a number of very minute drops; in other cases, the surface of the iron will be only dull for a moment, if no water exists in the specimen. The surface of the anvil should be blackened by oxidation, to exhibit clearly this very delicate test of the presence of water, which, as far as we know, has not been practised by any one else; it is far more convenient than the use of the glass matrass recommended by Berzelius and others, and no time is lost in applying it.

The action of this flux furnishes us with many important characters. The assay may emit a few bubbles of different sizes at first, which in most instances is owing to the portion of water which remains; or it may effervesce briskly, with intumescence, as carbonate of lime; some of the earthly minerals emit a stream of uniform minute bubbles for an instant; while a few, as Scapolite, emit them in a continued shower until the assay is entirely dissolved. Some minerals become transparent, others

* The term *flux* is applied to those substances which, when added to mineral bodies, assist their fusion upon exposure to the action of fire; and when we have observed the effect of the heat on the mineral alone, it is then necessary to examine what further change takes place when it is subjected to other trials with the fluxes.

become opaque, while a few change colour. Solution or fusion of the assay takes place quickly or slowly, wholly or partially, quietly or with effervescence.

But the most important of the characters afforded by this flux is the colour imparted to the glass, by which the presence of several metals is indicated. Chrome gives a rich green—iron, a dark olive-green colour with the glass: if the proportion of iron be very small, the colour is evident only while the glass is warm, a circumstance which, independent of the difference between the green caused by chrome and iron, is of some value in distinguishing them; for chrome becomes more clear when cold. Cobalt affords a very deep blue. We should also observe if the colour be different with the oxidating flame, from what it is with the reducing. Lastly, we observe if the colour increase or diminish by cooling: and if, at the same time, the glass preserve or lose its transparency.

Flaming.—Certain bodies have the property of forming a clear glass with borax, which preserves its transparency after cooling, but when slightly heated by the exterior flame of the candle, becomes opaque, and turns milk-white (Phosphate of Lime), or is coloured, particularly if the flame has been directed on the glass in an unequal and intermitting manner, as Glucina, Titanium. One condition, however, is necessary—that to a certain point the glass must be saturated with the assay: and the presence of silica also prevents the phenomenon, except when a very large proportion of the assay is dissolved in the borax. This property has been termed *flaming* by Berzelius.

2. *Salt of Phosphorus Flux*, or, as it is commonly called, microcosmic salt, is a double salt, or a compound of phosphate of soda and ammonia. It should be pure, which is known by the glass which it forms remaining transparent when cold.

One inconvenience attends the use of this flux; it intumesces to a great degree when heated. I have been in the habit of fusing the salt, allowing it to cool, and then reducing it to coarse powder: in this state it intumesces much less, owing to the ammonia driven off; and a biphosphate of soda remains, which is deliquescent, but if kept in wide-mouthed bottles closely stoppered, little inconvenience results from this. It is more particularly applicable to the examination of the metallic oxides, whose characteristic colours it develops much better than borax. It is also useful in detecting silica in earthy compounds, which it sets free, in the form of a gelatinous mass, in the globule.

3. *Saltpetre, or Nitrate of potash*—Should be kept in the state of crystal: it is used as an oxidating agent, and is a very delicate test of the presence of manganese, when it exists in a proportion too minute to colour the glass of borax without it. The following is the method I adopt:—Having fused a small portion of the assay with borax on platina-wire, the globule while warm is to be brought in contact with a small piece of nitre, which decrepitates at first, but a sufficient quality adheres. It is again submitted to the flame, and heated till intumescence takes place; and before the intumescence ceases it must be withdrawn, and allowed to cool, when an amethyst colour will appear, of more or less

intensity according to the proportion of the manganese, and this colour may be destroyed in the reducing flame. By this means I have detected the presence of manganese in minerals which escaped the attention of skilful chemists, as in Cyprine, and in a variety of white Aragonite from Devonshire.

4. *Nitrate of Cobalt.*—Nitrate of Cobalt, dissolved in distilled water, is employed to detect the presence of alumina and magnesia. The solution should be rather concentrated, and entirely free from alkali.

Alumina test.—The best mode in general of applying this test for alumina is to roast the assay in the outer flame until it becomes white, which in many instances renders it more absorbent; it is then moistened with a drop of the solution, and heated *strongly*, but *not fused:* after being heated for some time, the assay becomes blue, more or less pure, if it contain alumina. Wavellite exhibits this effect in a very striking manner. The blue colour of alumina is permanent in fusion, but it thereby loses its distinguishing character; for minerals which contain lime or alkali, without alumina, also become *blue* by fusion with oxide of cobalt, *but not till they have been fused.* The presence of a metallic oxide in the assay entirely destroys the action of this test, and hence its use is very limited, owing to the frequency with which iron is met with in earthy minerals. Silica does not prevent the appearance of the blue colour.

For the application of this test to the harder minerals, a different process is required. The stone is to be ground with a little water in an agate mortar till reduced to a state of pulp, a drop of which is to be laid on charcoal, which will absorb the water, whilst the fine powder will remain on the surface. To this we add a drop of the solution of cobalt, and heat it to the brightest incandescence, at which moment the characteristic action is developed, and becomes evident when the assay is cold. If we perceive the mass to detach itself from the charcoal in the form of a scale, we may take it up carefully with the platina forceps, and expose it more easily to the degree of heat required.

Magnesia test.—The process for detecting magnesia is similar to that already described, but in this case we must endeavour to fuse the assay; for the magnesia compound acquires a pale rose-red tint, which is generally stronger after fusion; its use, however, for this purpose is very limited, as there are few compounds of magnesia which do not contain either alumina or iron. The sub-hydrate is the best substance for exhibiting the action of the test.

IX.—Cupellation.

The process termed cupellation is only resorted to for the purpose of ascertaining the presence of gold or silver when alloyed with other metals, and is effected in the following manner:—A piece of bone which has been exposed to the heat of a fire until all the animal matter has been consumed, which is known by the bone becoming white, is reduced to a very fine powder, a small quantity of which is to be taken on the

point of a knife, moistened with the tongue, and kneaded in the left hand into a thick paste; a little soda may be added to give it cohesion, but it is not necessary. A hole is then made in a piece of charcoal, and filled with the paste, and its surface smoothed or slightly indented in the centre. It is then to be gently heated by the Blowpipe till it is perfectly dry. It is now ready for the assay, which must be previously fused with lead,* and then placed in the middle of the little cupel, and the whole heated by the exterior flame, for the purpose of oxidating the lead, which is absorbed together with the other impurities by the cupel. When the operation is finished, the precious metals are left on the surface; but the proportion of it being generally very small, owing to the size of the entire mass of the alloy often not exceeding a large shot, it is very generally necessary to have recourse to the magnifying glass to be certain of the presence or absence of the fine metal. When the grains are very minute, the colour of the metals will become evident by rubbing them in an agate mortar; and if any doubt exists, the application of a drop of nitric acid will speedily show the difference by its action on the silver, while it produces no effect on gold.

XI.—On the Duties of Mineral Agents. By G. C. Mahon, Esq, C. E.

[Read December 12, 1860.]

Introduction.

Some time since, on turning over the pages of a recent work on the Improvement of Estates,† I perceived that, though it treated fully and usefully of agriculture and forestry, the author distinctly declined to discuss the subject of the *mineral resources* of estates, as being, though logically, yet not practically, within the scope of the work; and I know of no book bearing directly on the subject. My profession has been that of a conveyancing attorney; but, having retired from practice, and having lived in a mining district, I have for some years past, and not unsuccessfully, applied myself to the discovery and improvement of its mineral capabilities; in doing so, I necessarily had to study, not only science bearing directly on mining, which I did in this country, and in France, but, what is much more important in a money point of view, the law and *practice* of mining negotiation, for which my original profession had to a certain extent prepared me.‡

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* When we wish to know if silver exists in an ore of lead, it is unnecessary to add any metallic lead to the assay.

† The Resources of Estates,—a Treatise on the Agricultural Improvement and General Management of Landed Property. By Lockhart Morton. Longman. 1858.

‡ It will be understood that I speak only of such mining as is carried on in Cornwall, and not of mining in coal and limestone districts.

Of the Mineral Agent's Relations with the Mine-lord.

What is a mineral agent? He is not a "mine-agent," who represents the mining capitalist as manager of a mine, nor is he the mine-jobber, the middle-man of mining, who represents every body and nobody by turns. The mineral agent represents the landlord, or "mine-lord," and no one else, and to his mineral property he stands in the same relation as his land-agent stands to his agricultural property.

The services which he renders are threefold, and cannot be kept too distinct from one another. He may be employed, 1st, on the discovery of a mine; 2nd, the letting of a mine; or, 3rd, the receipt of the toll or dues of a mine. The first two of these duties are, it is needless to say, by far more important to the employer, and difficult to the agent, than the third, though it almost always happens that this last is that for which the agent is the best paid: it is, in fact, the ignorance and short-sighted views evinced in the choice of mineral agents, able and willing honestly to discharge the first two of these duties, which have left many landlords so long without income from their mineral property.

Those who adopt this profession must remember that their own trouble and expense in discharging those duties properly will be very considerable; and as I am acquainted with the fact that many landlords expect to get everything for half nothing, I fully admit that it is necessary to stipulate beforehand for one's expenses in advance. Fair terms of remuneration are, one-half of the sum to be paid on the discovery of the mine, the other half on the completion of the lease. If, however, the landlord chooses to give as part payment his profits resulting from the mine, during the seventh, fourteenth, or twenty-first years of the term, he will act wisely, as, besides giving his mineral agent a general pecuniary interest identical with his own, he will insure an effective surveillance of the lessee at those three important periods. This mineral agent will, as it were, have created a property for him, which after the expiration of the term will probably be more valuable than at the commencement of it. The task is a difficult, anxious, and highly responsible one, which one cannot be expected to undertake from merely philanthropical motives; so that, besides paying the expenses, it is only fair that he should pay £50 for each lordship or townland examined, before the agent undertakes to look out for a lessee, and £50 more upon the completion of the usual twenty-one years' lease. The usual allowance in England is two guineas a day, besides expenses. If he desires the agent's surveillance of the lessee during the existence of the lease, the agent might undertake it on the terms of a reasonably high percentage, say ten per cent. on the three years' profits, as above. A lower scale of remuneration than this would be insufficient to repay the agent for his time and trouble.

A knowledge of mineralogy is, next to good habits of business, the most useful accomplishment of a mineral agent. Without it, inasmuch as minerals are the constituents of rocks, a thorough knowledge of minin

geology is simply impossible; it is also the great short cut to a knowledge of the chemical composition of mineral substances. In fact, a mineral agent might almost as well be without eyes, as without some practical knowledge of mineralogy, that is, a knowledge of the ordinary rough and ready tests for the discrimination of the obvious characters of minerals. The chief of these are their general appearance, "hardness," "streak," "specific gravity," &c.

Let us suppose that the agent is directed to examine a property for mines. How is he to set about his work, and what is he to do? He is first to examine all maps, and obtain from libraries, &c., all information relative to the district that he can—such sources are the Ordnance Survey, the Records of the School of Mines, &c.; then to lay down on his map, allowing for difference of level, the localities where the lodes known to exist on adjacent properties may be expected to traverse that to be examined. By this means he will gain some knowledge of the ground before putting his employer to the expense of visiting it. He chooses for his visit a time when the marshy places are comparatively dry. This done, he arrives, hammer in hand, on the property, and the natives crowd about him to see him run down his game. The best use he can make of them is, to select from among them any who say they have seen indications in the neighbourhood—go with them to the spots, even if not precisely on the estate, and lay them down carefully on his map, with a memorandum of the name of the informant, whether at first sight such indications appear valuable or not; he will thus probably get rid of his visitors seriatim, and will then be thrown on his own resources.

His first search will be for the most exposed parts of the fast rock of the property, some valley, ravine, water-course, cliff, or road-cutting, some quarries or old mining trials. Of these he should select, for first examination, such as have their escarpment most at right angles to the course of the known lodes of the district, and as he passes along them look out for rust-marks or "gossan" (decomposed iron pyrites), and mark the spots carefully on his map. This is the grand indication, though not either the only one, nor *invariably* a safe one. Veins of quartz, or any other substance differing from the mass of rock, especially iron pyrites (undecomposed gossan), also require attention. The rust-marks caused by bog-iron ore, or by water charged with iron, are no indication of the existence of mineral, except at a higher level than itself, and possibly very distant.

In case the ground does not present facilities of this kind, he will have to go to the expense of "trenching," or cutting the surface of the rock at right angles to the known run of the lodes of the district, choosing of course the gripes of ditches, and such other places as will be least damaged by an excavation, and the fast rock be reached with least expense. Before setting about this, he must, of course, calculate whether the probability of success is such as to justify the cost; but unless there is a considerable overburden of earth, the expense will not be found very

heavy, as a sinking of eighteen inches or so into the fast and settled rock will probably find the out-crop of every important lode. If there is a considerable overburden of earth, or if the surface is very valuable, it may be better to sink "costeening" pits, and to cut connexions through the rock from one to the other in the Cornish way. I take for granted that, as his examination progressed, he will have marked on the map the precise position of each discovery, with a distinguishing number or letter, and preserved specimens of the indications obtained, attaching to them a corresponding number or letter.

We will suppose that his trials have been successful, and that he has found the outcrop of a lode. He will proceed to ascertain its "strike;" that is to say, he will first follow the outcrop longitudinally, by an open cast excavation for a couple of fathoms or so, then take the bearings, and sink a pit accordingly, say ten fathoms off, until he finds it again. When he has sunk both to the same level, he can then take the bearings of the lode at the same level in these two spots. If he finds that these bearings agree exactly with those first observed, his next step may be a longer one, say fifty fathoms or so; and if he finds the lode thus, his next may be a stride of 100 fathoms. If the same result be obtained this time, he has not only fixed the strike of the lode for some 200 fathoms, but has proved it to be a straight running lode, possessed in all probability of considerable "decision of character," and "energy of action;" and mining capitalists will require little more than the proof of this fact, and of its width or "power," and the sight of suitable *bonâ fide* hand specimens, to induce them to enter at once upon the working of it. In all cases, the further the lode is traced, the more satisfactory it will be to them. It is most desirable, where possible, and where the indications warrant the expense, also to know the "dip" of the lode, for which purpose it should be followed down as far as water will permit. There is generally about a lode some ground much softer than the rest, and which will be found much cheaper either to drive or to sink on. Of course, every advantage must be taken of such circumstances. Influx of water is the main difficulty, and the mineral agent seldom persists in combating it farther than the common hand-windlass and buckets can go. At the lowest point which can thus be reached, the lode should be cross-cut, its "thickness," or "power," ascertained, and the contents of the lode at that level carefully noted, and so far "proof made in depth." A similar proof at the other extremity of the 200 fathoms will give the "bearings" and power of the lode in the utmost detail which any capitalist can reasonably expect from the mine-lord. These bearings, once obtained, are of the greatest importance for the purpose of comparing them with the bearings of other lodes of known value, and in other respects will greatly assist in setting the mine to work. Hand specimens should be carefully preserved, 1st, of the walls of the lode, the "hanging" as well as the "foot" wall; 2nd, of the sticky substance which is sometimes found adhering to the walls; 3rd, of the gangue or veinstone, and of the bearing part of the lode at a variety of levels. The careful

examination of these last requires all the mineralogical and chemical skill which the agent may possess, and very often even the services of a regular analytical chemist.

These are the data which determine the character of a lode, which identify it with others of the same system and of known value, and which, when a known valuable lode has been worked out or "heaved," and lost, at once identify the new lode as really the continuation of the lost one. Thus the infant mine perhaps starts at once with all the advantages of the experience acquired in working the old mine, and with all the prestige to which the old mine would be entitled, if it could begin its career again, perfectly known, yet with its contents unexhausted.

Of Dealing with the Mining Capitalist.

The choice of a lessee is nearly as important a matter as the proof of the existence of mineral wealth on the estate. When a good lode is discovered, there are several classes of men from whom proposals may be expected.

1st. The "Take-note" man, or "Bal-seller."
2nd. The neighbouring mine proprietor.
3rd. The *Half* Capitalist.
4th. The *bonâ fide* Capitalist.
5th. The Mining Company.

The "Take-note" man, if of known good character, may sometimes be of use; but, as a general rule, he is not a desirable person to deal with. His system in Cornwall generally is to get a promise of a lease for twenty-one years, at fixed dues, in the usual form of mining leases, provided he forms a company to the satisfaction of the mine-lord within a year.

In Ireland he is bolder; he asks, and often used to get, an unconditional promise of a lease without any stipulation as to form; and if he were only liberal in his *promises* to pay dues, the landlords used seldom to trouble their heads farther. In former times few jobbers of this description came to Ireland, except such as were hunted out of England for swindling in some shape or other. When they brought their "bal" to market in England, few men of character or capital cared to deal with them; and, as a natural consequence of the landlord's apathy in the choice of his agent, the mining property of Ireland has remained comparatively unproductive hitherto. The object of these men is, of course, to get as much money as soon as possible for their promise of a lease; and numerous are the good stories told of their cunning in overreaching both landlord and lessee. I have known the figure 1 introduced before the figure 5, so as to make a promise of a lease for five years appear to be for one of fifteen years, and the "bal" was actually sold as such. It is a common dodge to extort a good round sum from the landlord himself, under the threat of disfiguring his demesne, or injuring tenants for whose security the landlord has forgotten to stipulate: of all classes that I have ever met, these men are the sharpest.

A neighbouring mine proprietor often makes an early offer for a new discovery. If he has behaved fairly to a neighbouring landlord, and *bonâ fide* intends to work the mine, and will give valuable covenant to do so, I would on the whole prefer him to any one else, because of his greater experience in the district; but there is always risk of his playing "dog in the manger," in order to prevent the price of labour from being disturbed, &c. If his hands are already full, any proposal from him requires this point to be specially attended to.

By the "half capitalist" I mean a man, generally a retired mine captain, who has not capital enough to work the mine, but who has enough to enable him to expose the indications more fully than the landlord, from ignorance, from want of enterprise, or from poverty, will generally consent to do; he knows how to deal with the working miners better than any mineral agent, and generally knows where to find men of larger capital than he himself possesses, either for the purpose of selling his lease to them, or to associate with himself for the purpose of working the mine. On the whole, if his character be good, he is generally a most desirable person for landlords in not very wealthy circumstances to deal with; but, like most mining men, he is always a "fine point;" and, whether he is or not, deliberation and care are especially necessary before committing to writing any contract with him upon so intricate a subject as mining.

The *bonâ fide* capitalist is, of course, the most desirable person to deal with; he is, however, accustomed to have things sifted for him by other adventurers, and is content to pay them handsomely for their services; he is generally very exacting, and peremptory, and it will be found impossible to deal with him, or indeed with any of the other classes of lessees, unless you have very precise ideas of the terms on which you intend to deal, and are firm in insisting on them. Men of this kind know their own value perfectly, and require to be sought. The mineral agent should always have a list of such men by him, adding to it from time to time, as he hears of new men. When he has a mine to let, he will then find the use of the list; for he will only have to send a circular to each address *on the same day*, and to deal with the most desirable offer, to make sure that he has acted to the very best advantage for his client.

Companies are, in general, extremely undesirable to negociate with. You may have the clearest understanding possible with a leading director, or with the secretary, to-day; it may be in writing, it may even have taken the shape of a "resolution," duly passed at a meeting more or less solemn, and have been formally communicated to you as an "extract from the minutes;" yet to-morrow a "resolution" to precisely the opposite effect may be passed; and, as the *seal* of the company had not been affixed, you have practically no remedy.

Companies conducted upon the cost-book system, generally define their constitution by a memorandum written on the first page of the cost-book, where alone the mine-lord, shareholders, or creditors of the mine, can learn who the adventurers are, and upon what terms they are associated. It by no means follows, that all companies constructed upon the cost-

book system possess the same constitution, though it is generally understood that they have some features in common, especially that of the shareholders' liability being limited to cost incurred up to the time of getting his name "written off" the cost-book.

In conducting a negociation, make it your first rule *never to allow yourself to be hurried;* do not hesitate, especially when startled by unusual candour or liberality, to say plainly that you must take time to consider the matter.

I have already advised the agent to send out, on the same day, circulars to the addresses on the list of first-class men. The use of this is, that all their replies will come in about the same time; and he will thus be enabled, before closing with any of them, to compare the terms of the others. This he could not do, if he were to communicate with them *seriatim.*

When matters have got so far that the leading features of the contract, such as, 1st, the length of the term; 2nd, the minimum annual expenditure; 3rd, the royalty or dues, have been settled by correspondence, then come a host of thorny details, to be settled in a personal interview. A minute, resembling, *mutatis mutandis*, that in the appendix, and bringing matters as nearly as possible to a final ageeement *vivâ voce,* should be drawn out: this is not intended to be signed, but only to be a memorandum of what has passed. When he finds that it expresses clearly all that is intended by either party, let the lessee, if he likes, make a copy for his own use, the agent retaining that which is in his own hand-writing. It should then be placed in the hands of your client's attorney, to draw up a lease accordingly; for his trouble in connexion with which it is usual that he should be paid a fee of twenty guineas by the lessee, as a lumped sum in lieu of all costs.

The nature of the contract which should be made will depend upon so great a variety of circumstances, that they cannot all be anticipated here. I have, however, given, from actual practice, the form into which the minute above alluded to was expanded by able counsel. An examination of the printed precedents in works on conveyancing* will also be found useful.

If at any time, in the progress of the negociation, an intended lessee be found guilty of petty fraud, or even trickiness, it will be much better to break off with him at once; for it cannot be for the client's interest to have dealings on so complicated a subject as mining with a man of that character.

The receipt of the landlord's dues must be conducted in strict accordance with the terms of the lease, a copy of which the toller should provide himself with. By neglect of this he may afford justification to the lessee in putting an improper construction on the provisions of the lease; or may allow him, under the plea of "saving trouble," to establish a system very much to the landlord's disadvantage.

* The latest work on the subject is, "A Treatise on the Law of Mines and Minerals." By William Bainbridge, Esq., Butterworth. London: 1856.

Of Mineralogy.

Mineralogy is the science of minerals, and especially the part of the science which enables one to discriminate between minerals of different kinds. One great object of mineralogy is so to avail itself of past research, as to enable the student to arrive at a knowledge of the nature and chemical composition of minerals by a readier and cheaper method than that of actual chemical analysis in every instance.

Minerals are known by their *characters*, which are

I. General.

II. Chemical.

III. Geometrical or Crystalline.

I. The GENERAL CHARACTERS of minerals are those which any intelligent observer, unacquainted with chemistry or crystallography, might naturally remark: they are—

1st. Form, Cleavage, Structure, and Fracture.
2nd. Hardness and Streak.
3rd. Specific Gravity or Weight, as compared with other substances.
4th. Colour, Lustre, Transparency, Action on Polarized Light, and Phosphorescence.
5th. Taste, Smell, and Touch.
6th. Flexibility and Toughness.
7th. Sectility and Malleability.
8th. Magnetic Properties.
9th. Electric Properties.

Of these the first three are by far the most generally useful; and with a thorough knowledge of crystallography, the first alone is nearly sufficient to enable one to discriminate between all such minerals as happen to present themselves in a distinct crystalline form.

II. The CHEMICAL CHARACTERS of minerals are—

1. Effects of heat in glass tubes.
2. ,, ,, before the blowpipe.
3. Effects of liquid re-agents.

III. The GEOMETRICAL OR CRYSTALLINE characters of minerals are merely the details of the first of their "general" characters ("Form," &c.) viewed through the medium of geometry. They have been thought of almost sufficient importance to justify the study of crystallography as a separate science; but, interesting as they are, they constitute at the present day, rather the transcendental, than the practically useful part of mineralogy—rather the pedant's hobby than the student's help. They belong to theory rather than to practice, to the museum and the cabinet rather than to the field or the mine. Though it be true that there is no species of mineral without its peculiar crystallization, and further, that the same substance under the same circumstances always crystallizes in the same forms, yet as that form which is peculiar to it may not be its *ordinary* form, and as the circumstances which affect the crystallization of a mineral may not have been in all cases

the same, it is plain that absolute certainty, in the discrimination of minerals, is not always to be obtained by the study of the crystalline characters alone.

Every practical man knows the crystalline to be the *exceptional* state of minerals; and that it is a general rule, that the more important minerals, when found in quantity, are either wholly formless (amorphous); or else, that the crystals, as in the case of the ores of tin, are so minute and involved, that crystallography is of no use to him. He must therefore resort to the other characters, especially to the *chemical* characters, to determine their nature. On this account, the notice taken of the crystalline characters of minerals will be but slight.

If you, 1stly, merely poise a mineral in your hand—2ndly, examine it well—and, 3rdly, scratch it with the point of a knife—you will have had the opportunity of forming some rough opinion as to, 1st, its weight or specific gravity; 2nd, its colour, structure, &c.; 3rd, its hardness and "streak," or the colour of its powder. These little tests are few and simple; and when the eye has been once educated by the examination of a good number of well-labelled and characteristic specimens, it is surprising how very rarely it is necessary for the miner to resort to other tests.

"Hardness" is practically the most useful character. The nail, the teeth, a copper coin, a knife, and a crystal of quartz, form a scale of hardness sufficient for most purposes, but the regular scale is here subjoined.

It will be seen that the French and English scales differ, being exactly the converse of each other.

English Scale.	French Scale.		
10	1	Diamond.	The solid angles of pure crystals of these substances are the parts used.
9	2	Corundum.	
8	3	Brazilian Topaz.	
7	4	Quartz.	
6	5	Felspar.	
5	6	Apatite.	
4	7	Fluor Spar.	
3	8	Calc Spar.	
2	9	Rock-salt.	
1	10	Talc.	

A study of some of the systematic treatises on mineralogy* is necessary for the accomplished mineralogist. I do not pretend to supply their place; but, for the sake of convenient reference, I subjoin a table of the minerals of most importance to the practical miner.

The minerals enumerated comprise, in addition to the more important metallic ores, the earthy minerals usually found as constituent parts of the gangues, &c.

* Dana's "Manual of Mineralogy" is that used at the School of Mines in London, and is the most practically useful work of the kind.

Table of Characters of Ores.

	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness.		Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystallization.
			Scratches.	Scratched by.			
	Pt, ...	Steel-grey; streak shining,	Calc spar,	Apatite,	18·10	Malleable; absolutely infusible; soluble only in heated aqua-regia; gives lemon-yellow precipitate with NH_4Cl,	Cubic.
	Au, . . .	Gold-yellow to silver-white; streak shining,	Rocksalt,	Fluor,	16·75	Very sectile and malleable, spreading out under pressure of a steel point; before blowpipe, on charcoal, fusible,	Cubic.
	Ag, . . .	White, liable to tarnish; streak shining,	Rocksalt,	Fluor,	10·50	Very sectile, malleable, and flexible; before blowpipe, on charcoal, fuses without fumes; soluble in NO_5, on addition of ClH or NaCl, gives a white, curdy precipitate, soluble in NH_4O,	Cubic.
	AgS, Ag. 87,	Blackish, lead-grey; streak shining,	Talc,	Calc spar,	7·19	Cuts like lead; fuses in flame of candle;* before blowpipe, on charcoal, fuses with intumescence; with soda, yields bead of silver; soluble in NO_5, except sulphur,	Cubic.
ilver	6AgS, SbS_3, Ag. 70,	Iron-black; streak same,	Rocksalt,	Calc spar,	6·25	Sectile; before blowpipe, on charcoal, gives off S and Sb; yields a grey bead, which, with soda or borax in reducing flame, is reduced,	Trimetric.
l sil-	3AgS, SbS_3, Ag. 59,	Blackish, lead-grey to carmine-red; streak red,	Rocksalt,	Calc spar,	5·80	Slightly sectile; before blowpipe, on charcoal, gives off S and Sb, and is reduced,	Rhombohedral.
l re,	3AgS, AsS_3, Ag. 65,	Cochineal to Carmine-red; streak cochineal to orange,	Talc,	Calc spar,	5·55	Slightly sectile; before blowpipe, on charcoal, gives off S and As, and is reduced,	Rhombohedral.
	HgS, Hg. 86,	Brownish black to scarlet; streak brown to scarlet,	Rocksalt,	Calc spar,	8·10	Before blowpipe, on charcoal, wholly volatile, without fumes of As; in the closed tube, with soda, is reduced; soluble only in aqua regia,	Rhombohedral.

* An acid solution, containing silver, deposits metallic silver on a plate of copper.

Name.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness. Scratches.	Hardness. Scratched by.	Average Specific Gravity.	Chemical and othe Distinctive Charact
Tinstone, .	SnO_2, Sn. 78,	Colourless, grey, honey-yellow; hair-brown, black; streak light-grey, light-brown,	Apatite,	Topaz, .	6·90	Before blowpipe, on coal alone, infusible gives off no fumes; KCy reducible easily with soda with diffic in reducing flame; bead is soluble in yielding a lilac pı with $AuCl_3$; insol in all acids; its pov does not blacken p like that of Wolfı nor is it affected by NO_5, like Tungsten Blende; differs from Tı maline and Garnet specific gravity and sistance to the blowı on charcoal alone.
Copper,* .	Cu, . . .	Copper-red; streak shining,	Rocksalt,	Fluor, . .	8·55	Sectile, malleable, ductile; before blowpi on charcoal, fuses readi and on cooling, is coa with black oxide; solu easily in NO_5,
Ruby Copper,	Cu_2O, Cu. 88,	Fresh fracture cochineal-red to lead-grey; often covered by green and grey coating; streak brick-red, shining. N.B. The earthy variety, "Tile Ore," has few of these characters,	Calc spar,	Apatite, .	6·00	Before blowpipe, on ch coal, in reducing flam reduced; soluble with fervescence in NO_5; without effervescence ClH and in NH_4O,
Black oxide of copper,	CuO, Cu. 79,	Steel-grey to black; streak black,	Pulverulent,	. .	6·00	Generally earthy; befo blowpipe, on charcoal, reducing flame, is reduc
Azurite, .	$2(CuO,CO_2) + CuO.HO$ Cu. 55, . .	Blue; streak bluish,	Calc spar,	Apatite, .	3·80	In closed tube, gives HO, and blackens; b fore blowpipe, on ch coal, blackens, and is r duced to a slag of co per; soluble, with eff vescence, in NO_5,

* An acid solution of any ore of copper turns deep blue, with ammonia in excess. Metallic copper is pr it by a bright plate of iron. Hence mine water, or any other solution containing copper, will redde *knife*. The miner's rough test of an ore is to put some of it in powder on the wick of his candle, when, if it *it will tinge the flame bluish-green.*

me.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness.		Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystallization.
			Scratches.	Scratched by.			
hite, .	$CuO, CO_2 + CuO, HO$, Cu. 57,	Green; streak lighter green,	Calc spar,	Apatite,	3·85	In closed tube, decrepitates, gives off HO, and blackens; otherwise behaves like preceding,	Monoclinic.
us er,	Cu_2S, Cu. 79,	Blackish lead-grey, sometimes iridescent; streak shining,	Rocksalt,	Fluor, .	5·65	Very sectile; before blowpipe, on charcoal, melts easily, with effervescence; in oxidizing flame, with soda, yields bead of copper; soluble in warm NO_5, leaving S undissolved,	Trimetric.
cop-	$4Cu_2S, + Fe_2S_3$, Cu. 55,	Copper-red to pinchbeck-brown, coated with iridescent or purple-tarnish; purple streak,	Rocksalt,	Fluor, .	5·00	Fresh fracture horse-flesh or liver-coloured; rather sectile; before blowpipe, on charcoal, turns black, and, after cooling, red; after long exposure to the flame, fuses into a steel-grey, brittle, magnetic globule; with borax and soda, yields ultimately a globule of copper; mostly soluble in NO_5,	Cubic.
op- erz, -	$4Cu_2S, SbS_3$, Cu. 38, and at times Ag. 30; contains also Fe, Zn, and As,	Steel-grey to iron-black; streak generally the same as colour,	Rocksalt,	Apatite,	4·80	Yields to knife, but brittle; the miner's test for massive varieties is *cutting* it; in open tube, gives fumes of Sb, SO_2, and at times As; as a general rule, the darker it is, the less As it contains; before blowpipe, on charcoal, fuses with slight ebullition into green slag, usually magnetic, giving with borax a grey metallic globule, which with soda yields a globule of copper; NO_5 decomposes it in powder, giving off red fumes, separating SbO_3, S, and sometimes AsO_3,	Cubic.
s,	Cu_2S, Fe_2S_3, Cu. 34,	Brass-yellow, sometimes iridescent; streak greenish-black,	Calc spar,	Apatite,	4·20	Fresh fracture brass-yellow; yields easily to the knife; before blowpipe, on charcoal, gives off S, and yields a brittle, grey, magnetic globule, soluble in aqua regia, with separation of S undissolved,	Dimetric.

Name.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness. Scratches.	Hardness. Scratched by.	Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystalliza-
Carbonate of lead,*	PbO, CO_2, Pb. 75,	Colourless to lead grey; peculiar fatty lustre; streak white,	Calc spar,	Fluor,	6·50	In the amorphous state very deceptive; sometimes resembling limestone in everything but weight; before blowpipe on charcoal, decrepitates if not pulverized, effervesces, becomes yellow, and is reduced; soluble with effervescence in NO_5.	Trime
Galena,	PbS, Pb 86, sometimes also Ag. 3,	Lead-grey to black; streak same,	Rocksalt,	Calc spar,	7·50	Decrepitates generally when heated; before blowpipe on charcoal alone, before oxidizing flame covers charcoal with yellow sublimate; after roasting this at a dull red heat, it fuses in reducing flame, giving off fumes of S, and is reduced; partially soluble in NO_5 yielding yellow precipitate with $KO,2CrO_3$; the black granular varieties are the richest in silver,	Cubic.
Red oxide of zinc,†	Zn O, Zn. 80,	Garnet-red; streak, orange-yellow,	Calc spar,	Apatite,	5·48	Before blowpipe alone infusible, soluble without effervescence in NO_5,	Rhombo hedral
Calamine,	ZnO, CO_2, Zn. 52,	Colourless to (frequently) brown; streak, white,	Fluor,	Felspar,	4·39	Before blowpipe on charcoal gives off zinc fumes, soluble with effervescence in NO_5.	Rhomb hedral
Electric Calamine,	$2(3ZnO, SiO_3)+3HO$, Zn. 53, sometimes anhydrous,	Colourless to (rarely) brown; streak, white,	Fluor,	Felspar,	3·40	More brittle than the foregoing; gives off water when calcined; before blowpipe on charcoal swells, and gives off Zn, fumes but slightly; in powder soluble without effervescence in hot SO_3 or HCl, gelatinizes on cooling,	Trimet Rhomb hedral (The a hydro variet

* Before the blowpipe in oxidizing flame, minerals of lead in general cover the charcoal and assay with a sublimate, is red while hot, yellow on cooling, soluble in nitric acid, and yields a white precipitate to sulphuric, yellow to chromic

† Before the blowpipe the minerals of zinc in general cover the charcoal with a sublimate, which is lemon-yellow *hot, white on cooling*, and green on being moistened with nitrate of cobalt, and ignited.

ıe.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness.		Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystallization.
			Scratches.	Scratched by.			
,	ZnS, Zn. 67,	Green, yellow, red, brown, black; streak white to reddish brown,	Calc spar,	Apatite,	4·10	Easily distinguishable from Garnet, Idocrase, and Tinstone, by its yielding at once to the point of a knife; before blowpipe infusible on charcoal; decrepitates; when strongly heated in oxidizing flame, yields fumes of Zn; in powder soluble, except the sulphur, in concentrated nitric acid, almost always giving off SH,	Cubic.
ıc or oxide ,	FeO, Fe_2O_3, Fe. 72,	Iron-black; streak black,	Apatite,	Quartz,	5·08	Strongly attracted by the magnet; an invariable constituent of basaltic rocks; before blowpipe turns brown, and loses its magnetic properties; scarcely fusible; in powder completely soluble in hot ClH, not in NO_5,	Cubic.
ır ır red tite,	Fe_2O_3, Fe. 70,	Steel grey; the metallic varieties often iridescent to iron-black; the concretionary and earthy varieties red; streak violet-brown to cherry-red,	Apatite,	Quartz.	5·00	Sometimes slightly attracted by the magnet; before blowpipe alone infusible; in powder becomes black and magnetic; slowly soluble in hot HlC,	Rhombohedral.
ıs of ɔr ı hæ- ,	$2Fe_2O_3$ + 3HO, Fe. 59,	Black to yellowish brown; streak yellow; white, brown,	Fluor,	Felspar,	3·67	In the matrass yields HO; before blowpipe blackens, and becomes magnetic,	Not found crystallized.

l ores of iron, excepting iron pyrites, are soluble in ClH. If to the solution a little nitric acid be added, and it be boiled, eld a blue precipitate with yellow ferrocyanide of potassium, and a red solution with sulphocyanide of potassium.

Name.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness. Scratches.	Hardness. Scratched by	Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystallisa-
Carbonate of iron,	FeO, CO_2, Fe. 48,	White to chestnut-brown; streak white to grey,	Calc spar,	Apatite,	3·8 Earthy varieties, 3·25	Before blowpipe infusible alone, but blackens and becomes magnetic; in powder, soluble with effervescence in hot HCl; the white varieties closely resemble calc spar, but turn brown on exposure,	Rhom hed
Iron Pyrites.	FeS_2, S. 53,	Silver-white to bronze-yellow; streak greenish grey,	Felspar,	Quartz,	5·00	In the matrass yields a sublimate of S; before blowpipe on charcoal gives off SO_2, and in reducing flame ultimately melts into black magnetic globules; arsenical pyrites is easily distinguished from it by the smell of garlic before the blowpipe on charcoal, or even when smartly struck with a steel; magnetic pyrites, by its inferior hardness, and its slightly affecting the magnet,	Cubical Trimetri
Peroxide of manganese, Pyrolusite,*	MnO_2, O. 36,†	Steel-grey to iron-black; streak black,	Rock salt,	Calc spar,	4·85	In the matrass yields no water when pure; before blowpipe with borax in oxidizing flame gives violet glass; soluble in HCl, with strong smell of Cl; easily distinguished from the poorer ores by the blackness of its streak,	Trimetri
Hydrous oxide of manganese, Manganite,	Mn_2O_3, HO, O. 27,	Steel grey to iron-black; streak brown,	Calc spar,	Apatite,	4·28	In matrass yields water; before blowpipe and with acids behaves like the foregoing, distinguishable by its browner streak,	Trimet

* Ores of manganese yield chlorine when heated with ClH.

† [Since manganese ores are valued according to the amount of chlorine which they are capable of yielding, it [illegible] well to add that 100 grains of pure pyrolusite yield 81 of chlorine, while 100 grains of manganite yield 40.—ED.]

...me.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness. Scratches.	Hardness. Scratched by.	Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystallization.
...y co-...	$CoO+2MnO_2+4HO$, Co. 14 to 30,	Blue-black to black; streak shining,	Pulveru-lent,	. . . .	2·40	Before blowpipe with borax in oxidizing flame gives violet glass; in reducing flame gives a smalt-blue glass; becomes shining when rubbed hard,	Pulveru-lent.
...t ...e co-	CoS_2+CoAs, Co. 35, As. 45,	Silver-white, slightly reddish, sometimes tarnished; streak greyish-black,	Apatite,	Felspar,	6·20	Best distinguished from iron pyrites by its chemical characters; in matrass unchanged; before blowpipe, on charcoal, fuses with strong smell of garlic; with borax in oxidizing flame gives a deep blue glass; soluble in NO_5 with a lilac-pink colour,	Cubic, with cleavage parallel to the three faces of the cube.
...hite ...t,	Co As, Co. 28, As. 72,	Tin-white, also steel-grey to silver-white, sometimes tarnished; streak greyish-black,	Apatite,	Felspar,	6·48	Behaves like foregoing, but gives off the smell of garlic in the flame of a candle, or even with a smart blow, or strong friction,	Cubic.
...; ...1,	$3CoO, AsO_5+8HO$, Co. 29,	Red of various shades, with, in general, a peculiar lavender-blue tint, sometimes grey or green; streak a little paler; powder lavender-blue when dried,	Talc, . .	Calc spar,	3·00	In the matrass gives off HO, and turns blue or green; before blowpipe and with acids like the foregoing,	Monoclinic.
...,	$Ni_2 As$, Ni. 44, As. 55,	Bronze-yellow to pale copper-red, with black tarnish; streak pale brown-black,	Fluor, .	Felspar,	7·60 Inferior varieties as low as 6·60,	In the matrass yields no sublimate; before blowpipe on charcoal gives off smell of garlic; fuses into a brittle white metallic globule, slowly soluble in strong NO_5 in which it quickly assumes a green coating; more easily soluble in aqua-regia,	Rhombohedral.

...alt can often be recognised in an acid solution by the blue mark occasioned by putting a drop of the solution on ...er, and drying it before the fire. This colour disappears on cooling.

...e solutions of nickel are green; they are turned blue by excess of ammonia, but not of so deep a colour as those of

Name.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness.		Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystallisation.
			Scratches.	Scratched by.			
White Nickel,	NiAs, Ni. 28, As. 71,	Tin-white, with bluish-grey or black tarnish; streak, greyish blue,	Apatite, .	Felspar, .	6·50	In matrass yields a sublimate of metallic As, leaving a copper-red residue; before blowpipe on charcoal like foregoing, but the globule continues to glow after removal from the flame; soluble in NO_5 and aqua-regia,	Cubic.
Bismuth, .	Bi, Bi. 100, sometimes accompanied by arsenic,	Silver-white, inclining to red; liable to tarnish; streak same,	Talc, . .	Calc spar,	9·70	Melts in the flame of a candle; before blowpipe coats the charcoal yellowish brown, disappears without rising in fumes; soluble, with effervescence, in NO_5, which then yields a white precipitate, on the addition of water in excess,	Rhombohedral.
Sulphuret of antimony,	SbS_3, Sb. 72,	Bluish lead-grey to bluish steel-grey; streak lead-grey,	Talc, .	Calc spar,	4·65	Sectile; greasy to the touch; very fusible, melting at once in the flame of a candle, and colouring it greenish; before blowpipe on charcoal disappears, giving off odour of SO_2, and rising in thick, white fumes, which deposit on the charcoal a white sublimate, of which the colour does not change on cooling, and which may be driven from place to place before the flame; soluble in hot ClH, disengaging SH; in NO_5 a yellow residuum of oxide of antimony remains,	Trimetric.
Arsenic, . .	As, As. 100, sometimes accompanied by silver,	Tin-white, with grey tarnish; streak same,	Calc spar,	Fluor, .	5·75	In the matrass is sublimed; before blowpipe, on charcoal, burns with pale-bluish flame, and is wholly volatilized in white fumes, with smell of garlic, which is also perceptible on giving the mineral a smart blow with the hammer,	Rhombohedral.

e.	Chemical Formula and per-centage of valuable Elements.	Colour and Streak.	Hardness.		Average Specific Gravity.	Chemical and other Distinctive Characters.	Crystallization.
			Scratches.	Scratched by.			
lende, of um,	UO, U_2O_3, U. 84,	Pitch-black, sometimes greyish, greenish, brownish, or red; streak greenish-black,	Apatite,	Felspar,	6·50	Easily distinguished from Blende and Chrome Iron by its high specific gravity, from Wolfram by its streak; before blowpipe, with salt of phosphorus, yields a yellow globule in oxidising flame, and a green one in reducing flame; soluble in powder, slowly in hot NO_5, giving off red fumes, and forming a yellow solution,	Cubic.
le-	MoS_2. Mo. 58,	Lead-grey, with metallic lustre; streak, on paper, lead-grey; on porcelain a dirty green,	Talc, . .	Rocksalt,	4·55	Unctuous to the touch, easily distinguishable from Graphite, Sulphuret of Antimony, and Specular Iron, by its greenish streak on porcelain, and by the difficulty of pulverising it; before blowpipe, on charcoal, gives off SO_2, and coats the charcoal with a pulverulent white sublimate; in powder, is decomposed by NO_5, leaving greyish residue of MoO_3,	Rhombohedral.
n,	(Fe or Mn)O WO_3, WO_3. 75,	Greyish to brownish-black; streak reddish-brown,	Apatite, .	Felspar, .	7·25	Easily distinguished from Tinstone by its streak; before blowpipe, on charcoal, fuses to a black metallic button, studded with small crystals; with salt of phosphorus, in reducing flame, yields a deep-red globule, on the addition of tin; in powder, decomposed by hot HCl, with deposition of WO_3, as a yellow powder,	Trimetric.

The earthy minerals of most importance as the gangues of metalliferous veins, or the constituents of ore-bearing rocks, are—

Quartz.	Idocrase.
Felspar (Orthose and Albite).	Epidote.
Anorthite.	Andalusite.
Mica (Uniaxial and Biaxial).	Kyanite.
Talc.	Tourmaline.
Chlorite.	Beryl.
Hornblende.	Topaz.
Pyroxene (Augite).	Apatite.
Hypersthene.	Fluor spar.
Diallage.	Carbonate of Lime (Calc spar).
Peridot (Olivine).	Dolomite.
Garnet.	Sulphate of Barytes (Heavy Spar).

The description of these may be readily found in Dana's Manual, or any ordinary work on mineralogy.

Of Mining Geology.

This is a very large subject, It is one about which little has been written; for little is accurately known, and that little is generally of mere local value. Great writers, such as Murchison, Lyell, and De la Beche, evidently felt it to be dangerous ground; and, accordingly, they either evade it, or skim over it very lightly indeed. De la Beche's "How to Observe," is a useful introductory book. Some master mind of high generalizing powers is much wanted, to trace to their causes, and give to the world, in simple language, some knowledge of the laws which govern the productiveness of mineral veins.*

Cornwall is the grand source of information on this subject; and Mr. William J. Henwood has made a noble and gigantic effort, in the 5th volume of the Transactions of the Royal Geological Society of Cornwall, to place the facts before the world in an intelligible shape. Still, any one who reads Captain Charles Thomas's Remarks on the Geology of Cornwall and Devon, will see that more than high generalizing powers are required; and that much as Mr. Henwood has done in a right direction, and vast as is the mass of details which he has so clearly arranged, it is necessary to descend into particulars still more minute, as Captain Thomas has admirably done in the case of his own mine of Dolcoath, before one can say that a knowledge of the law has actually been deduced from the facts observed.

* As a whole, the most useful book on Geology, as applied to mining, is probably "The Metallic Wealth of the United States. By J. D. Whitney. Trübner: London, 1854." This work treats not merely of American mines (as its name would seem to import), but is an effort, and a successful one, to view science in a practical manner, divesting it of pedantry and mystification, and pointing directly, as well as clearly, to its application.

The practical miner is at present, in almost every case, the best geologist in his own locality; but his observations and experience will be best appreciated by, and will be most useful to him who has studied mining geology systematically in other localities as well. At present, I can only refer the reader to Cornwall, and the works above mentioned.

Of Mineral Chemistry.

An attempt at a complete treatise on the ordinary processes of assaying would be out of place here. I shall therefore give a few methods, for the most part volumetric, for the determination of the substances most commonly subjected to examination by the mineral chemist.

I.—To ascertain the Commercial Value of an Ore of Manganese, by means of Volumetric Analysis. (Marguerite.)

The value of an ore of manganese depends—

(*a*) Upon the percentage of binoxide of manganese contained in it, inasmuch as its power of producing chlorine is in direct proportion to this per-centage. If the ore be not binoxide, it is still considered as composed of binoxide mixed with protoxide in various proportions.

(*b*.) Upon the percentage of muriatic acid absorbed by lime, iron, and other soluble impurities, and consequently wasted.

(*c*.) Upon the percentage of other substances, which, though they do not absorb muriatic acid, yet cause expense in transport and laboratory space; e. g. quartz and barytes.

The first of these elements is that principally employed in calculating the value, the quotation generally being at such a price for mineral containing 100 per cent. The third of the elements is seldom taken into account.

A.—*Preparation of the Test-liquid and Determination of its Strength.*—Take 2 parts of pure pyrolusite, well pulverized, 1 part of chlorate of potash, and 3 of caustic potash; mix them, and calcine at a low heat, in a covered clay crucible. When cold, break the crucible, and dissolve the green substance which it contains, which is the manganate of potash (KO, MnO_3), in water. To the green solution add dilute nitric acid (equal volumes of water and acid) drop by drop, until the colour becomes a reddish violet. This change is produced by the formation of the permanganate of potash (KO, Mn_2O_7), at the expense of a portion of the manganic acid, which is thrown down as a dark precipitate in the state of binoxide. The liquid becomes strongly alkaline in this process. Fill a funnel with powdered glass and filter through it.* The liquid

* [The reason of using powdered glass is, that contact with any organic substance, such as filtering paper, decomposes the permanganate. It is less troublesome to clear the solution by allowing it to stand, and then to decant it.—Ed.]

thus obtained is known as the "mineral chameleon," or "Liqueur Marguerite."

Its strength is determined by means of iron; and, in consequence of the great facility with which it undergoes alteration, this operation must be repeated at intervals.

In order to effect this, one gramme of the finest piano wire, perfectly bright, is weighed and dissolved in a matrass, in about 100 grammes of muriatic acid, heat being used if necessary. The solution is greenish, and contains protochloride of iron. It ought to be strongly acid in order to prevent the precipitation of the peroxide of iron by the potash. Add $\frac{3}{4}$ litre of common water, quite cold. Fill a burette* up to zero, with the chameleon, and add the contents, drop by drop, to the solution of iron, stirring constantly with a glass rod, until the whole solution takes a faint rose-colour. Note the number of cubic centimetres (e.g. 40 c.c.) of chameleon required to produce this effect. This number (40) expresses the strength of the solution; or, in other words, forty cubic centimetres of it are exactly sufficient to bring 1 gramme of iron, present in the state of protochloride, to the state of perchloride.

B.—*To ascertain the Quantity of Binoxide of Manganese in an Ore.*—Take 5·6 grammes of the finest iron piano wire as before; introduce it into a matrass,† and add 100 to 150 grammes of pure concentrated muriatic acid.‡ Dissolve as above, when the solution will contain the protochloride of iron. Weigh 4·36 grammes of the manganese ore,§ which must be prepared by taking portions from various parts of the specimen, in order to give a fair average assay, pulverizing them all together, and then taking a quantity which must be reduced to an impalpable powder. Fold the assay in filtering paper; introduce it into the matrass, taking care to replace the cork immediately. On shaking slightly, the reaction commences, which must sometimes be assisted by gentle heat: chlorine is developed, and acts on the protochloride of iron in the matrass, converting it into perchloride. When the reaction is complete, shake again to absorb any chlorine which may be free in the matrass, and empty into a vessel holding about a litre, taking care to rinse the matrass

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* The form of burette best adapted for this analysis is the alkalimeter of Gay Lussac, a description of which may be found in any of the text-books on inorganic chemistry.

† The matrass should be of the capacity of about 400 c.c. The cork should fit tightly, and be pierced with a straight funnel-tube, the pointed end of which should not pass more than three or four millimetres under the surface of the liquid in the matrass.

‡ The muriatic acid must be free from sulphuric and nitric acids. The former is tested by the chloride of barium; the latter by means of green vitriol, in the following way:—Take a little of the suspected acid in a test-tube, add half its own volume of pure sulphuric acid to it, and after it has cooled drop in a crystal of the green vitriol. If the crystal be immediately covered with a red coating, there is nitric acid in the muriatic acid.

§ The numbers 4·36 and 5·6 are chosen, because that, if the manganese ore were pure peroxide, these numbers would express the exact ratio of the quantities in which the peroxide and metallic iron act on each other.

with water. Dilute largely with water, until the liquid has a pale yellowish colour. Fill the burette with chameleon, and add it, drop by drop, to the iron solution, as soon as the latter is perfectly cold. As long as there is any protochloride of iron present, the red colour of the chameleon is destroyed instantly, and the liquid retains the pale yellow tinge at first observable in it. When the reaction is complete, a single drop of the chameleon will turn the whole liquid a light rose-colour. Note the number of cubic centimetres of chameleon which has been required to convert the residue of protochloride of iron to the state of perchloride. The difference between the amount thus obtained and the original quantity of protochloride will give the amount of peroxide of manganese by a simple calculation, the steps of which are as follows:—

Let the strength of the chameleon be 40, and let the number of cubic centimetres of it required to produce the rose-colour be 80. This proves that 2 grm. of iron were left unaltered by the action of the chlorine set free by the manganese. Hence, we find that the amount of iron brought to the state of perchloride by the action of the 4·36 grm. of manganese ore was 3·6 grm. We may then reason thus:—If the whole 5·6 grm. of iron had been acted on by the manganese, it would have proved the ore to contain 100 per cent. of peroxide. We have, therefore, the following proportion:—

$$5{\cdot}6 : 3{\cdot}6 :: 100 : x.$$

Whence x is found to be 64·3. The ore, therefore, contains 64·3 per cent. of pure peroxide.

C.—*To ascertain Percentage of Muriatic Acid wasted by the Lime, Iron, or other Soluble Impurities.*—In order to do this, we must first ascertain the strength of the muriatic acid, as follows:—

Make a solution of muriatic acid of the density of 1·09, by the help of the areometer. The percentage of pure acid therein contained is thus determined:—

Dissolve 145 grm. of pure anhydrous carbonate of soda (obtained by calcining pure crystals) in a litre of distilled water. Each cubic centimetre of this solution denotes 0·1 grm. of pure muriatic acid.*

Take a quantity of the acid to be tested, say 15 grm., introduce it into a beaker-glass, dilute, and add infusion of litmus, until the liquid turns red. Then fill the burette with the soda solution, and add the contents carefully to the acid liquid, taking care to stir constantly, until the colour changes to a bluish or violet tinge. Note the amount of the test-liquid required to produce this change, and calculate the amount of muriatic acid in the solution, by dividing the number of cubic centimetres so noted by 10.

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* [This proportion is deduced from the following considerations:—As a litre of the soda solution contains 145 grm. of NaO, CO_2, it is clear that each cubic centimetre will contain 0·145 grm. of that substance. The equivalent numbers of HCl and NaO, CO_2 being 36·5 and 53 respectively, we have the following proportion:—$53 : 36{\cdot}5 :: 0{\cdot}145 : x$; whence $x = 0{\cdot}1$.—Ed.]

Having thus ascertained the strength of the acid, we proceed to determine the amount wasted by the soluble impurities of the manganese ore, as follows:—Take a quantity of muriatic acid of known strength, which will be equivalent to 15 grm. of pure acid; pour it into a matrass similar to that used above, and dissolve in it a known quantity of manganese ore (say 6 grm.), whose purity has been already determined. When the solution is complete, determine, by the use of the burette and soda solution, the quantity of pure acid remaining in the liquid. Let this quantity be found to be 2 grm., and let the quantity required to dissolve the manganese ore be 10 grm. We find, then, that the amount of pure muriatic wasted by the lime, iron, and other soluble impurities, is 3 grm. The value of this amount is to be deducted in calculating the value of the ore.

D.—*Determination of the Insoluble Impurities, such as Quartz, &c.*—The amount of the insoluble residue is easily determined by simple weighing, and if it exceed the admitted percentage of insoluble impurities, the expense of its carriage, &c., is to be added to the purchaser's claim on the tender.

II.—To ascertain the Amount of Iron in an Ore by means of Volumetric Analysis. (Marguerite.)

Select and pulverize a fair average sample of the ore, as in the case of the manganese, and weigh out 1 grm. if the ore be rich, more if it be poor. Dissolve in muriatic acid, dilute to the bulk of about $\frac{1}{3}$ of a litre, with distilled water, and add six times the weight of the assay of metallic lime, in order to reduce the iron to the state of a protosalt. As soon as the liquid has become colourless, which will be the case when the reduction is complete, remove the excess of zinc, and add chameleon, precisely as in the analysis of manganese ores, until the liquid assumes a rose-colour.

If the strength of the solution of chameleon, as before, be 40 c.c. = 1 grm. of metallic iron, we can, of course, calculate the percentage of that substance in the ore. Supposing that 35 c.c. have been required to convert the iron contained in 1·25 grammes of ore to the state of a persalt, we have the following proportions:—

To find the amount of metallic iron contained in the assay,

$$40 : 35 :: 1 : x \quad \therefore \quad x = 0{\cdot}875.$$

$$\therefore \text{The percentage} = \frac{87{\cdot}5}{1{\cdot}25} = 70.$$

III.—To ascertain the Quantity of Copper in an Ore by means of Volumetric Analysis. (Pelouze.)

This method is founded upon the following properties of copper:—1st. That all solutions of that metal are coloured deep blue by the addition of ammonia in excess. 2dly. That sulphide of sodium precipitates all the copper in a *hot* solution, in the state of oxy-sulphide

($5\ CuS + CuO$), before precipitating any of the other metals usually found associated with its ores. The sole exception is silver, for which see Practical Observations, p. 260. If nickel or cobalt be present in the ore, this method is inapplicable, as the solutions of these metals are coloured blue by ammonia.

The presence of nickel must be first tested by means of the cyanide of potassium, which will give an apple-green precipitate, even in an ammoniacal solution, if nickel be present. If there be no nickel, we may assume that there is no cobalt, and the process may be proceeded with.

A.—*Preparation of the Test-Liquid.*—If pure crystalline sulphide of sodium can be procured, it is only necessary to dissolve 60 grm. of it in 100 c.c. of distilled water. Each cubic centimetre of such a solution required to destroy the blue colour of a solution of copper will denote one per cent. of copper in the assay, if one gramme be used, and so in inverse proportion if more than one gramme be taken. If the pure crystals are not to be procured, take 140 or 150 grm. of the commercial sulphide, and dissolve in a litre of water. If the solution be allowed to stand for a few days, there will probably be a small sediment of sulphate of lead formed. Decant off the clear solution, and keep it in a closely stoppered and full bottle. The re-agent has a great tendency to oxidation, and consequent formation of sulphate of soda.

In order to test the strength of this solution, we take 1 grm. of perfectly pure copper (the metal obtained by electrolysis, or by reduction of the pure oxide by means of hydrogen, is the best to use). Dissolve in 20 or 30 c.c. of pure nitric acid, in a vessel of the capacity of about 250 c.c. If this solution be slightly opalescent, the metal will have contained antimony or tin. Silver and lead are detected by the white precipitates given by the addition of muriatic and sulphuric acid respectively. Ammonia tests further for lead, and also for iron. Arsenic is best detected by the smell of garlic before the blow-pipe. If we are satisfied of the purity of the copper, we may proceed to the operation. Add 30 or 40 c.c. of water of ammonia. The liquid will turn deep blue, and should be heated slowly and very carefully over the gas-lamp until it boils.* Fill the burette with the solution of the sulphide, and add it to the solution of copper while it is boiling gently, but so gradually as not to stop the boiling. The precipitate will form at once, and will have the definite composition $5CuS + CuO$. The matrass should be shaken occasionally to prevent the liquid bumping. Towards the end of the operation it becomes difficult to observe the blue colour of the liquid, in consequence of the amount of black precipitate suspended in it. It must therefore be withdrawn from the lamp for a moment, and the sides of the matrass must be washed with a few drops

* It is necessary to attend particularly to this part of the process, otherwise the precipitate obtained will be very light, so that it will require a long time to form, and it will not have the composition $5Cu\ S + Cu\ O$.

of ammonia. If the liquid be still blue, proceed with the addition of the sulphide until the blue colour totally disappears. Note the number of cubic centimetres required to produce this effect; this number will be the strength of the solution; e.g. 32 c.c. are required to saturate 1 grm. of copper.

B.—*Analysis of a Sample of Copper Ore.*—Pulverize and take 1 gramme, if it be rich, and a corresponding quantity if it be poor, in copper. Dissolve in aqua-regia, unless we are assaying alloys, when it is better to use acetic acid. Filter and wash out the undissolved residue, if there be any; add 20 to 30 c.c. of water of ammonia. If the precipitate of iron be large, it must be removed by filtration, and washed on the filter with ammoniacal water. Heat the filtered solution very carefully, as before, till it begins to boil. Take 32 c.c. of the test-liquid (equivalent to 1 gramme of copper); dilute to 100 c.c. and add to the boiling solution of copper until complete discolouration ensues. Note the quantity employed.

The calculation is very simple. If we have used 1 gramme of the assay, we have 1 per cent. of copper for every c.c. of the test-liquid employed. If more than 1 gramme have been used, e. g. 26 grm., we have $\frac{1}{26}$ per cent. of copper for every cubic centimetre used.

If the substance to be examined be mine water, a certain quantity is weighed or measured, acidulated with nitric acid and boiled, in order to convert the protoxide of iron, which is always present, into peroxide, and finally treated as above. The calculation is precisely similar to that first made.

Practical Observations.—In order to prove the absolute purity of the nitric acid, add a little ammonia, and, if it becomes at all turbid, it contains impurities.

If the mineral contains silver, it will be precipitated by the muriatic acid of the aqua-regia, and the chloride must be filtered off and washed. If nitric acid be employed as the solvent, it is absolutely necessary to remove silver, if present, by muriatic acid, as the sulphide of sodium precipitates silver *before* it precipitates copper.

None of the other metals interfere with the reaction. Zinc aids it as it falls next after copper, and, by the white colour of its sulphuret, marks very distinctly the completion of the analysis.

IV.—To ascertain the Quantity of Tin in Tin-stone by Volumetric Analysis. (Gaultier de Claubry.)

Tin is rarely found in nature, except in the form of binoxide, and is never worked as an ore in any other state.

A.—*To ascertain whether the Mineral contains Tin or not.*—Reduce a portion to an impalpable powder, and mix, in an agate mortar, with equal volumes of carbonate of soda and cyanide of potassium, dried carefully.

Treat the assay on charcoal with the reducing flame of the blowpipe. A metallic globule will be obtained, which must be dissolved in

muriatic acid, and the solution divided into three or four watch-glasses, a drop in each.

Test for the protochloride of tin with a drop of the terchloride of gold, which will give with it purple of Cassius.

Test another portion of the solution with sulphuretted hydrogen, which throws down the protochloride brown (SnS), and the perchloride yellow (SnS_2).

Test also with the solution of iodine, after adding the starch solution. A small quantity turns the perchloride blue; a larger quantity is required for the protochloride.

B.—*The Volumetric Determination.*—This process depends on the following properties of the metal:—

(1.) That metallic iron reduces solutions of the perchloride of tin to the state of protochloride.

(2.) That iodine converts solutions of the protochloride to the state of perchloride.

The test-liquid is prepared by dissolving 1·26 grm. of pure iodine in 100 c.c. of alcohol. This solution is sufficient to convert 0·59 grm. of metallic tin existing in the state of protochloride to the state of the perchloride.

In order to assay the mineral, weigh 0·59 grm.; reduce it to an impalpable powder, and calcine it in a silver crucible. When well mixed with three or four times its weight of caustic potash, or carbonate of soda, add muriatic acid in excess to the contents of the crucible. The solution will contain all the tin which is in the mineral in the state of perchloride.

In order to reduce it to the state of protochloride, add to it an excess of pure metallic iron, about three times the weight of the assay. When the reaction is complete, remove the excess of iron; add a few drops of starch paste, and then add from a burette the test-liquid of iodine, until a blue colour is produced, proving the completion of the process.

Note the number of c.c. used, deducting the last drop, and calculate 1 per cent. of tin for each c.c. of the solution employed.

This reaction is not affected by the presence of sulphur, iron, arsenic, or copper.

The iodine solution should be kept in a cool, dark place, and in a blue or covered well-corked bottle.

V.—To ascertain the Quantity of Silver in an Ore which does not contain Lead, by means of Volumetric Analysis. (Gay Lussac.)

This method is founded on the property possessed by a solution of common salt, of precipitating the whole of the silver contained in an acid solution, in the state of chloride, in the form of a curdy white precipitate. This chloride of silver forms into a glutinous mass when shaken, and sinks to the bottom, leaving the liquid above perfectly clear, so that the slightest cloud may be perceived.

The reaction is only interfered with by lead and mercury, for the presence of which metals the proper tests must be applied.—(See the "Practical Observations.") If lead be present, the ordinary methods of analysis must be resorted to.

A.—*To prepare the Test-Liquid.*—Dissolve in a litre of distilled water 5·426 grm. of pure chloride of sodium; 100 c.c. of such a solution will exactly precipitate 1 grm. of pure silver. If, therefore, the weight of the assay be 1 grm., each cubic centimetre of the test-liquid denotes 1 per cent. of silver in the assay. This strong solution is, however, only used in the beginning of the process. In order to complete it, a second solution is requisite, whose strength is one-tenth that of the solution above described, and of which, therefore, each cubic centimetre denotes 0·1 per cent. of silver in the assay.

The chloride of sodium employed should be well dried, and tested for the usual impurities, viz., sulphate of magnesia and the chlorides of potassium and calcium. If the operator should not possess a balance capable of weighing to milligrammes, he must take ten times the quantity of both salt and water to form a solution with the requisite accuracy.

B.—*Performance of the Analytical Process.*—Pulverize and weigh 1 gramme of the ore, and introduce it into a matrass. Add 6 to 12 c.c. of pure nitric acid and a drop of sulphuric acid (to facilitate the solution of any sulphide of silver that may be present). Heat gently until the solution is complete, and the nitrous fumes have ceased. Filter into a large beaker-glass, rinsing the matrass carefully and washing the filter. Add acetate of ammonia in excess if mercury be present. Fill the burette with the salt solution No. 1, and add it to the contents of the beaker-glass, taking care to stir continually. This is best done by moving the beaker itself briskly round and round.

Continue the addition of No. 1 as long as the precipitate is formed copiously, and note the quantity used. Then fill the burette with solution No. 2, and add as above, until the last drop fails to produce the slightest cloud. Note the amount used, and calculate each c.c. of No. 1 as 1 per cent., and each c.c. of No. 2 as 0·1 per cent. of metallic silver in the assay.

Practical Observations.—When the mineral is very poor, weigh 30 or 40 grm. or more for the assay. Dissolve as above; filter and wash. Then evaporate partly, in order to reduce the bulk of the liquid, and proceed as above, excepting that the solution No. 2 is used throughout. Calculate accordingly. As each cubic centimetre denotes 0·1 grm. per cent., if 1 grm. of assay be used, so, in inverse proportion, if more than 1 grm. be used; e. g. if 26 grm. be used, each c.c. denotes $\frac{1}{260}$ grm. per cent. of silver.

No metals, except lead or mercury, interfere with this reaction. The presence of lead is fatal. The best test for it is the reducing

flame of the blowpipe, which deposits on the charcoal a yellow sublimate of oxide of lead, which remains yellow when cold. The presence of mercury is best ascertained by heating the mineral with caustic soda (or better, with a mixture of caustic lime and carbonate of soda in equal volumes) in a bent test-tube. If there be any mercury in the ore, it will appear in little drops on the sides of the tube. Mercury interferes with the process, inasmuch as it prevents the settling of the chloride of silver, unless acetate of ammonia has been previously added to the solution in nitric acid. $\frac{1}{1000}$ part per cent. of mercury in the ore will be sufficient to keep the chloride of silver from sinking.

If the ore contain gold, that metal will exist as a brown powder among the insoluble residue of the ore.

VI.—To ascertain the Quantity of Silver and other Elements in an Ore which contains Lead.

In this case the preceding method is of no use. Reduce the mineral to an impalpable powder, and weigh, in a weighed test-tube, 4 grm. of it, if it be very rich in silver; 20 grm. or so if it be poor. Introduce it, by means of the test-tube, into the bulb of a reduction-tube with bent end.* Let the curved end be plunged into water contained in a small flask, A, which is three-fourths full, and the cork of which is pierced by a second tube. This tube leads into a second flask, B, containing carbonate of soda or milk of lime, in order to absorb the excess of chlorine set free in the process. Attach to the other end of the reduction-tube a chloride of calcium tube, and connect it with an apparatus for the liberation of chlorine. The gas must be liberated *very* slowly, and allowed to pass at a rate as nearly uniform as possible through the apparatus.

Apply a lighted spirit-lamp to the bulb as soon as it appears to be filled with chlorine, and heat the assay very gently. The decomposition is soon completed, and the bulb is then heated fully with the lamp.

All the metals are converted into chlorides, and the sulphur to chloride of sulphur (SCl), which passes into the water in the flask A, and is there decomposed, the sulphur remaining either uncombined, or in the form of sulphuric acid.

As soon as the white vapours cease to pass from the bulb, the heat is to be discontinued, and the flame of the lamp passed onwards to the angle of the tube, so as to expel all the volatile matter which may lie between the bulb and the angle. When this is done, the whole is allowed to cool, and the tube cut at the angle.

Weigh the remainder of the tube with the assay in it, and note the weight. Fill it with strong water of ammonia, heating very slightly. This re-agent dissolves all the chloride of silver without affecting the chloride of lead. Pour off the liquor, and repeat the washing with ammonia as before. Dry the tube, driving off the ammonia, and weigh

* For the figure of the apparatus we must refer to Fresenius.

again. The difference between this weight and that previously taken will give the amount of chloride of silver. Calculate the amount of metallic silver corresponding to this weight of the chloride, by multiplying it by the fraction, $\frac{108}{143 \cdot 5} = 0 \cdot 7527$. In order to check this part of the analysis, the ammoniacal solution of the chloride is supersaturated with nitric acid, and the chloride thus precipitated consolidated by shaking, and washed by decantation. The washed chloride of silver is finally reduced in a small weighed porcelain capsule, and weighed. The difference between the two weighings gives the amount of metallic silver directly, which should agree with the amount obtained by calculation as above. If there be mercury present in the ore, the former estimation, by weighing the tube, will be useless, as the weight of the chloride of mercury will not remain unchanged. If copper be present, it remains as chloride in the bulb with the silver and lead. Dissolve it in dilute muriatic acid, which does not affect the other metals, and wash carefully. Determine the copper in this solution by means of the solution of sulphide of sodium (p. 258). Heat the bulb, to expel the muriatic acid, before adding the ammonia to remove the silver.

If iron be present, it will have been converted into the state of sesquichloride, and be contained in the water in A. Its amount may be estimated by means of the solution of permanganate of potash as before. The arsenic and antimony are also contained in this flask, and the presence of the iron does not interfere in the least with their being determined in the old way, if desirable.

The lead is contained in the bulb, and may be removed from it, without breaking the glass, by means of sulphide of potassium.

In order to estimate the amount of sulphur:—This is contained either uncombined or as sulphuric acid in the water in A. Heat the flask to expel all the chlorine. Filter through a weighed filter, and dry the well-washed filter between watch-glasses in a water-bath. On re-weighing the filter, its increase of weight gives the quantity of free sulphur. The remainder is present in the filtrate in the form of sulphuric acid, and must be precipitated by excess of chloride of barium, the solution being subsequently warmed. A heavy white precipitate (BaO, SO_3) is thrown down. Decant and wash the precipitate on a filter. Dry and calcine the precipitate and the filter, separately. Weigh as BaO, SO_3, and multiply by

$$\frac{16}{116.5} = 0 \cdot 1373, \text{ to obtain the amount of sulphur.}$$

In order to ascertain the amount of mercury in the ore:—The whole of this metal remains with the lead in the bulb; it is not dissolved by the ammonia, but is converted into the oxide. Dissolve it after removal of the silver, by means of nitric acid, which will not affect the chloride of lead. Wash with dilute nitric acid, and heat to dryness again. Weigh the tube a third time, and the difference between the second and third weighings gives the mercury in the state of oxide.

VII.—To Ascertain the Amount of Phosphoric Acid contained in an Ore of Iron.

A.—By volumetric analysis. (*Raewsky.*)*

B.—By ordinary weight-analysis.

The presence of 1 per cent. of phosphoric acid in ores of iron, which are otherwise excellent, has hitherto been found an almost insurmountable obstacle to the production of good pig iron from them. It is therefore of the greatest importance to determine its amount accurately. For this purpose two processes will be given, in order to enable the experimenter to check his results. This impurity may always be expected in the hydrated peroxide, or brown hæmatite, especially in the variety called bog-iron ore.

The first method is founded on the following three properties of phosphates:—

(*a.*) That the alkaline phosphates are the only ones soluble in water.

(*β.*) That the earthy, and most of the metallic phosphates are soluble in muriatic, and also in acetic acid.

(*γ.*) That the tribasic phosphate of the peroxide of iron is soluble in muriatic acid, but not in acetic acid.

A.—*Performance of the Volumetric Process.*—Reduce the mineral to an impalpable powder in an agate mortar; weigh 20 grm., and dissolve in a matrass, with muriatic acid in excess. Filter and wash with distilled water. The whole of the phosphoric acid will be contained in the filtrate. Add, when cold, a *cold* solution of the acetate of soda or potash, until the liquor turns of a deep red colour, indicating that the whole of the muriatic acid has been neutralized by the alkali, and that the acetic acid is consequently in great excess. Let the whole stand for twenty-four hours, if possible, at all events for two hours, and a yellowish white precipitate will be observed floating in the liquor. This precipitate contains all the phosphoric acid, in the form of tribasic phosphate of the peroxide of iron (Fe_2O_3, PO_5), containing 71·4 parts of phosphoric acid for every 56 parts of metallic iron.

Filter and wash with distilled water. Then change the beaker-glass for a fresh one, and dissolve the precipitate in the filter by means of hot muriatic acid, washing the filter carefully with hot water. Add as much water as will make half a litre, and then 5 or 6 grm. of metallic zinc, in order to reduce the iron to the state of protochloride (precisely as in the determination of iron, p. 258). As soon as the liquid has become colourless, or but slightly green, remove the excess of zinc. Add cold water, until the bulk of the liquid is one litre, and allow the whole to cool completely.

* The method, as here presented, is due, in some of the modifications from Raewsky's original method, to M. Weil, Ingenieur Chimiste, Paris.

Estimate the amount of iron in the solution by the use of chameleon, as above (p. 258). The calculation is carried out as follows:—The proportion which the iron bears to the phosphoric acid is $56:71{\cdot}4$, and therefore $\frac{71{\cdot}4}{56}$, or $1{\cdot}275$, is the coefficient by which the amount of iron obtained is to be multiplied to obtain the corresponding amount of phosphoric acid; e. g. if the strength of the chameleon be 40 c.c. to 1 grm. of iron, and if 7·4 c.c. of the solution were required to produce the red colour in a solution of the phosphate of iron obtained from 20 grm. of bog iron ore; then we have the following proportion:—

$$40 : 7{\cdot}4 :: 1{\cdot}275 : x.$$

Whence we find, $x = 0{\cdot}2712$ grm., or 1·356 per cent.

B.—The second method is founded on the solubility of the alkaline phosphates in water, and the insolubility of the phosphates of all other bases. Dissolve 20 grm. of the finely-pulverized mineral in aqua-regia. Evaporate to dryness, to separate the silica, and then add a few drops of acid to redissolve the bases before the addition of water. After allowing the whole to stand for a time, add water, and filter. Supersaturate with carbonate of soda, proving the liquid to be alkaline with test-paper. Heat the liquid to boiling heat, and a red precipitate will be found, containing the whole of the phosphoric acid, as tribasic phosphate of iron, and the remainder of the iron, as hydrated peroxide. Filter the solution, and wash and dry the precipitate. Mix it with four times its weight of carbonate of soda, and calcine in a platinum crucible. By this means the phosphate of iron is decomposed completely, and the phosphoric acid combined with the soda to form a soluble compound, while the peroxide of iron is quite insoluble. Boil the contents of the crucible with distilled water, and filter. The filtrate contains phosphate of soda; and, on the addition of acetate of lead, a precipitate of phosphate of lead will be formed. Filter, wash, dry, calcine, and weigh it as $3PbO, PO_5$.

In order to calculate the amount, we have the following proportion, supposing w to be the amount of phosphate of lead obtained by analysis:—

$$182{\cdot}4 : 71{\cdot}4 :: w : x.$$

VIII.—To ascertain the Presence and Amount of Phosphoric Acid in the Phosphates of Lime and the other Earthy Bases.

The examination of impure phosphates—e. g. coprolites—is a problem frequently presented to the chemist; and I shall, therefore, describe briefly the qualitative and quantitative methods of performing such an analysis.

A.—*Qualitative.*—Dissolve in aqua-regia, and filter, to separate the silica. Add a few drops of pure perchloride of iron, if that metal be not already present in the solution, and then excess of a cold solution of acetate of soda. The phosphoric acid, if present, will form the tribasic phosphate of iron, and appear as a whitish precipitate.

If it be required to prove that the earth is lime, the solution must be boiled, in order to throw down the residue of the iron as hydrated peroxide. The liquid, after filtration, will contain the lime, and yield a white precipitate with oxalate of ammonia.

B.—*Quantitative.*—Proceed exactly as in the second method for the estimation of phosphoric acid in iron ore, with the exception that, before adding carbonate of soda to the solution, you add a few drops of the perchloride of iron, if that metal be not present in the assay.

IX.—To ascertain the Amount of Arsenic in Iron Pyrites, Qualitative and Quantitative.

A.—*Qualitative.*—Pulverize the mineral, and introduce a small quantity of it into a bulb test-tube. Add six times the volume of the assay of dried carbonate of soda and cyanide of potassium, mixed in equal volumes, taking care that the bulb is not more than half full.

Heat over a spirit-lamp, beginning at the top of the tube, and going down gradually to the bulb.

If arsenic be present in the mineral, a black mirror of arsenic will be formed near the top of the tube, and by driving it up by heat to the very top of the tube, the odour of garlic, arising from metallic arsenic, will be perceptible.

If this test be insufficient, dissolve the black sublimate by boiling for an hour or more, until dissolved, in aerated water (i. e. distilled water, which has been exposed to the action of the air for a fortnight or so). This gives a solution of arsenious acid.

Add acetic acid and excess of caustic potash, until the liquor is alkaline; then evaporate to dryness, and calcine the residue. A substance called alkarsin will be formed, the odour of which is so powerful and unpleasant, that it cannot be mistaken.

B.—*Quantitative.*—This method is founded on the fact, that arsenides, when boiled in aqua-regia, are converted to arseniates.

Dissolve a weighed portion of the assay in aqua-regia, and pass sulphuretted hydrogen into the solution. When saturated, allow it to stand twenty-four hours in a warm place. A yellow precipitate of the tersulphide of arsenic, mixed with free sulphur, is formed. Filter and wash this precipitate, and treat it with bicarbonate of ammonia, which will only dissolve the sulphide of arsenic, leaving the sulphur untouched. Acidify with muriatic acid, and the whole of the arsenic will be thrown down as pure tersulphide. This must be caught on a filter previously weighed and dried, and then dried at water heat, and weighed as AsS_3.

If copper, lead, or other metals, precipitated by sulphuretted hydrogen, be present, they must be removed. In order to remove the copper, we treat the precipitate of sulphides, which contains sulphide of copper, with sulphide of sodium, instead of bicarbonate of ammonia. This re-agent does not affect the copper, but dissolves the sulphide of arsenic and the free sulphur; and we may regain the dissolved substances, after filtration, by the addition of muriatic acid.

Of Mine Surveying.

In mine surveying, although the work of the survey is usually plotted geometrically, it is of great importance to be able to check the construction by calculation. The calculation* is easily effected by trigonometrical tables, so that it is unnecessary to do more than give a few examples, which will serve to illustrate any case that may occur in practice.

I. *Sinking of Shafts.*—As the lode is not always vertical, but declines from the vertical by an angle called the *underlay*, it is often necessary to calculate the true vertical depth of any point of the lode, from measurements made on the lode, and observation of its underlay.

Let D, D′, &c., denote the lengths of the several drafts, and u, u', &c., their respective underlays; then the total depth of the point in question will be found from the expression,

$$\text{Depth} = D \cos u + D' \cos u' + \&c.; \qquad (1)$$

and the horizontal distance is given by the expression,

$$\text{Horizontal distance} = D \sin u + D' \sin u' + \&c. \qquad (2)$$

In equation (1), all the quantities are to be added together, but in equation (2), if any of the drafts occur on a portion of the lode which has *changed* its underlay, they are to be taken with a negative sign, and subtracted from the sum of the remaining drafts.

1. A downright shaft, measuring 57 feet, was found to intersect a lode, whose underlay was 39° 30′; find the length of the lode discovered, and the distance of its outcrop from the shaft.

	Ft.	In.
Ans. Length $= 57 \times \sec 39° 30' =$	73	10
Distance $= 57 \times \tan 39° 30' =$	46	11

2. A horizontal cross-cut from the foot of a downright shaft, is made to intersect a lode whose underlay is 50°, the cross-cut measures 224 feet 8 inches; find the length of the lode between the cross-cut and the intersection of the lode and downright shaft, and the depth of the downright shaft.

	Ft.	In.
Ans. Length = 224 feet 8 inches × cosec 50° =	293	3
Depth = 224 feet 8 inches × cotan 50° =	188	6

3. In dialling a shaft sunk on a lode, it was found that the first draft and the second draft measured as follows—

No.	Draft.	Underlay.	D cos u.	D sin u.
1	71 feet	14° 45′		
2	54 ,,	40 15		

* Many of the following examples are taken from Mr. Budge's "Practical Miner's Guide;" but they are here solved by a method somewhat more expeditious than that which he has used.

Required the depth of the downright shaft, which should be sunk to take the lode at the end of the second draft, and the distance from the brace of the diagonal shaft, at which it should be commenced.

		Ft.	In.
Ans.	Depth =	109	10
	Distance =	52	11

NOTE.—This calculation is most easily performed by using the tabular form given, and filling in the blanks from the trigonemetrical tables; and then using equations (1) and (2).

4. A diagonal shaft was found to underlay and measure as follows:—

No.	Draft.	Underlay.	D cos *u*.	D sin *u*.
1	54 ft.	+ 18° 45′		
2	42 „	+ 12 15		
3	69 „	+ 25 0		
4	96 „	− 7 30		

Find the depth and distance as before.

		Ft.	In.
Ans.	Depth =	+ 249	10
	Distance =	42	10

NOTE.—In this example the lode changes its underlay between the third and fourth draft.

5. Two lodes were discovered at the surface, 12 fathoms apart, both underlaying north; the underlay of the southernmost lode was 38° 15′, and that of the northernmost lode, 23°; find the perpendicular depth at which they will intersect.

Ans. Depth = 32 fms., 5 ft., 4 in.

6. Two lodes, 36 fms. apart, are observed at surface; the northernmost lode underlaying south, 18° 15′, and the southernmost lode undermost lode underlaying north 31°45′; find the depth at which they will intersect.

Ans. Depth = 38 fms.

7. From the foot of a perpendicular shaft, 70 fms. in depth, a cross-cut was driven south 14 fms. 3 ft. in length, when a lode was discovered underlaying north, 17° 15′; required the length of this lode from the end of the drift to 'grass;' also, the distance from the brace of the perpendicular shaft, to the 'back' of the lode, supposing it to have a regular underlay.

		Fms.	Ft.	In.
Ans.	Length =	73	1	9
	Distance =	36	1	5

8. From the depth of 36 fms. 4 ft., in an engine-shaft, a cross-cut was driven, which pierced a lode, after being driven 14 fms. 2 ft.; this

lode was found to underlay 30° towards the engine-shaft. Find the depth at which the shaft will intersect the lode, and the length of the latter between the two intersections.

		Fms.	Ft.	In.
Ans.	Depth	= 61	2	11
	Length	= 28	4	0

9. A shaft is sunk on a lode a certain distance, when the lode is found to be separated and thrown up by a slide, the lode is afterwards recovered by rising on the slide, and again worked; find the total depth of the working, and the horizontal distance at which a downright shaft should be sunk to reach the end.

No.	Draft.	Underlay.	D cos u.	D sin u.
1st part of lode,	+ 114 feet.	+ 54° 30′		
Slide,	− 32 „	− 43 0		
2nd part of lode,	+ 73 „	+ 51 0		

		Ft.	In.
Ans.	Depth	= 88	8
	Distance	= 171	4

NOTE.—In this example, the slide has a negative sign, both in its draft and underlay, which must be borne in mind in making the calculations.

10. Let the slide be supposed to dislocate the lode downwards, and to have an underlay opposite to that of the parts of the lode.

No.	Draft.	Underlay.	Rise or Fall. D cos u.	Hor. Distance. D sin u.
1st part of lode,	+ 77 feet.	+ 34° 45′		
Slide,	+ 40 „	− 59 0		
2nd part of lode,	+ 102 „	+ 42 15		

		Feet.
Ans.	Depth	= 159·33
	Distance	= 78·16

II. *Traverse Dialling.*—In traverse dialling, it is usual to estimate by trigonometrical computation the effect of each draft, as *Northing* or *Southing*, *Easting* or *Westing;* to subtract the Northing and Southing from each other, and the Easting and Westing; and, finally, calculate from the right-angled triangle found as the result of these subtractions. As the levels are usually without sensible inclination, the *Rise* and *Fall* may be neglected, but, if required, they may easily be computed. The

sights on mining dials are fixed at the north and south points, and the eye of the observer is to be placed at the south end of the dial in the direct survey, and at the north end in the reverse survey. As some dials are graduated from 0° to 360°, by east, south, and west; these are called right-hand-dials; while those that are graduated from 0° to 360°, by west, south, and east, are called left-hand-dials.

When the sight is taken, the observation consists in recording the degree at which the north end of the needle stands; and in converting these observations into bearings, great care must be taken not to confound the right-hand and left-hand dials.

Let it be required to convert the following observations into bearings, first, on the supposition that they were taken with a left-hand dial, and secondly, that they were taken with a right-hand dial:—

Observations.	Bearings. Left-hand Dial.	Bearings. Right-hand Dial.
$210\frac{1}{4}$	$30\frac{1}{4}°$ W. of S.	$30\frac{1}{4}°$ E. of S.
$176\frac{1}{4}$	$3\frac{1}{2}$ E. of S.	$3\frac{1}{4}$ W. of S.
$305\frac{3}{4}$	$54\frac{1}{4}$ W. of N.	$54\frac{1}{4}$ E. of N.
$28\frac{1}{2}$	$28\frac{1}{2}$ E. of N.	$28\frac{1}{2}$ W. of N.
$107\frac{1}{8}$	$72\frac{7}{8}$ E. of S.	$72\frac{7}{8}$ W. of S.
$97\frac{3}{4}$	$82\frac{1}{4}$ E. of S.	$82\frac{1}{4}$ W. of S.
348	12 W. of N.	12 E. of N.

From this example, it will be evident that the dial does not alter the Northing or Southing of the bearings, and that the Easting and Westing are transposed.

It saves much trouble, also, in the calculations, to refer all the bearings to the north and south line, as is done in the preceding table, without regarding whether they are less or greater than 45°.

Let ϕ, ϕ', &c., denote the bearings of the several drafts, referred to the north or south line, and let i, i', &c., denote the inclinations or depressions of the levels.

Then we shall have the following system of simple equations to determine the Northing or Southing, the Easting or Westing, and the Rise or Fall of the *end* of the level:—

$$\text{Northing or Southing} = D \operatorname{Cos} \phi + D' \operatorname{Cos} \phi' + \&c. \qquad (3)$$
$$\text{Easting or Westing} = D \operatorname{Sin} \phi + D' \operatorname{Sin} \phi' + \&c. \qquad (4)$$
$$\text{Rise or fall} = D \operatorname{Sin} i + D' \operatorname{Sin} i' + \&c. \qquad (5)$$

The utility of these equations will be evident from a few examples—

1. It is required to sink a perpendicular shaft on the end of a level, whose bearings and drafts measured as follows:—

No.	Draft.	Bearings.	Northing. D cos ϕ.	Southing. D cos ϕ.	Easting. D sin ϕ.	Westing. D sin ϕ.
	Fms. Ft. In.					
1	8 5 6	16° 30′ E. of S.				
2	3 4 11	26 0 W. of S.				
3	9 4 0	19 0 E. of S.				
4	3 3 6	34 30 W. of S.				
5	8 5 8	57 30 W. of S.				
6	4 5 10	39 30 E. of S.				

Find the distance and bearing of the point at which the sinking of the shaft should be commenced.

In working this example, it will be found best to divide the inches by 12, to add the quotient to the feet, and divide by 6; this will give decimals of a fathom, with which the Trigonometrical and Logarithmic Tables may be entered.

		Fms.
Easting	=	8·840
Westing	=	11·248
Southing	=	32·715

Subtracting the Easting from the Westing, we find 2·408 fms., which, with the Southing, 32·715 fms., make up the two sides of a right-angled triangle. Solving this triangle, we find—

Ans. Bearing = 4° 13′ W. of S.
Distance = 32·803 fms.

2. Given the following course of traverse dialling, made with a left-hand dial; find the distance and bearing of the extreme point—

No.	Draft.	Bearing.		Northing. D cos ϕ.	Southing. D cos ϕ.	Easting. D sin ϕ.	Westing. D sin ϕ.
1	36·00 ft.	162°	18° E. of S.				
2	44·33 ,,	143¾	36¼ E. of S.				
3	30·75 ,,	16½	16½ E. of N.				
4	28·50 ,,	257¼	77¼ W. of S.				
5	17·83 ,,	45	45 E. of N.				
6	15·25 ,,	7¾	7¾ E. of N.				
7	72·00 ,,	152½	27½ E. of S.				
8	16·00 ,,	87½	87½ E. of N.				
9	73·00 ,,	204½	24½ W. of S.				

Distance =
Bearing . =

3. It is required to sink a vertical shaft on the end of a level, and the diallings from the bottom of an old downright shaft are as follows:—

Surveyed with a right-hand Dial.

		Fms.	Ft.	In.
1.	. . . . $356\frac{1}{4}°$	18	3	0
2.	. . . . $84\frac{1}{2}°$	12	1	6
3.	. . . . $98°$	15	4	0
4.	A Winze 322°, underlay $25\frac{1}{2}°$, inclined length 11 fms. 2 ft.			
5.	. . . . $107\frac{3}{4}°$	25	5	6 End.

		Ft.	In.
Ans. Northing	=	143	7·8
Southing	=	60	7·2
Easting	=	242	2·9
Westing	=	93	1·0

4. It is intended to sink a shaft on the end of a level driven from Pendarves' shaft, and the following is the survey from the centre of Pendarves' shaft to the end of the level:—

	Draft.	Bearing.	No.	Draft.	Bearing.
1	45 ft. 0 in.	3° W. of N.	6	27 ft. 0 in.	$6\frac{3}{4}°$ S. of E.
2	24 „ 6 „	$7\frac{1}{4}$ N. of E.	7	16 „ 5 „	15 S. of E.
3	18 „ 0 „	$8\frac{1}{2}$ N. of E.	8	21 „ 0 „	5 N. of E.
4	49 „ 1 „	East.	9	14 „ 7 „	$12\frac{1}{4}$ N. of E.
5	30 „ 0 „	12 S. of E.	10	28 „ 0 „	9 W. of N.

	Ft.	In.
Ans. Distance =	203	$11\frac{1}{4}$
Bearing =	20° N. of E.	

Miscellaneous Problems.

1. A lode was opened on the back by costeening in several places; and its course, by compass, was found to be $10\frac{1}{2}°$ S. of E.; but this was on the ascent of a steep hill whose angle of elevation was $16\frac{1}{2}°$; and the lode underlay 3 feet in a perpendicular fathom. What is the *true* bearing or course of the lode?

Ans. 2° 6′ S. of E.

2. An oblique shaft was found to measure 89 feet 6 inches, on an angle of 53° 15′; and it was also observed that the shaft had declined 3° 45′ west from the intended right angle of the east and west lode; find the amount of error in the bottom of the shaft, and the perpendicular depth of the mine.

	Ft.
Ans. Error =	5·85
Depth =	53·55

3. In drawing ore from a shaft 250 fathoms deep, by two ropes of the weight of 10 pounds per fathom, the load of ore is half a ton; at what point of the shaft will the whim begin to overrun the horses drawing it?

Ans. 69 fathoms from grass.

4. The celebrated tin carbona of the St. Ives Consols Mines has a total length of 126 fathoms; its upper extremity joins the 78 fathoms level of the standard lode, which is vertical, and bears 35° N. of E., the carbona itself bearing 42° N. of W., and having its lower extremity at the depth of 100 fathoms below adit. Find the perpendicular distance from the standard lode at which a shaft should be sunk to reach the lower extremity of the carbona.

5. The stamps at Polberro are worked at the following rate:—

a. Revolutions per minute, ...	$8\frac{1}{4}$
b. Stampers, ...	72
c. Height through which the stampers are lifted by the cams,	9 in.
d. Weight of stamper, ...	600 lbs.
e. Average number of blows per minute, ...	45

This machinery stamped in 1854, of tin ore, 30,201 tons. Express in horse-power the work done in pulverizing this ore, assuming the stamps to work 10 hours per day for six days in the week.

6. Two lodes intersect each other, and are found to be rich at their junction; I want to sink a shaft upon the line of intersection, to take the vein at a given depth, and therefore require to know the bearing and underlay of the line of intersection. It is observed that the first lode bears N. 10° E., underlay 50° S., and the second lode bears E. 15° N., underlay 47° N.

7. In the Rammelsberg Mine, the *Gottlob Flacker* and the *Glückauf Spat* intersect each other, with the following bearings and underlay:—

Gottlob Flacker, S. 40° E., underlay 80° S. W.
Glückauf Spat, E. 15 S., „ 50 S.

8. The course of a lode is found by compass to be E. 17° N., underlay 2 feet per fathom N.; and this course is measured on the back of the lode on the side of a hill rising 25° N. Find the true course of the lode.

9. The cross-course from Van Dieman's Land to Glendalough Mine bears 25° N. of E., and at a distance of 313 fathoms from the middle level of Glendalough Mine it throws off a south branch bearing 15° N. of E.; the bearing of the lode itself in the middle level is 3° E. of N. At what distance in the level will the north branch intersect it, the south branch of the cross-course appearing just at the mouth of the level?

10. An adit level is required to be driven (in the Red Andrew Mine near Aue) to reach the bottom of the Stolln shaft, and intersect the Rosina and Red Andrew Lodes; the ground rises from the adit mouth to the Rosina lode for a distance of 36 fathoms at an angle of 8° 30′; from

the Rosina lode to the Red Andrew lode $4\frac{1}{2}$ fathoms; and from the Red Andrew lode to the mouth of the Stolln shaft, 24 fathoms; the Rosina lode has an underlay of 33° towards the adit mouth, and the Andrew lode a similar underlay from the adit mouth. Find the lengths of adit to be driven, to intersect the two lodes and engine shaft respectively.

Appendix.

I.—TAKE NOTE USED IN CORNWALL.

I, the undersigned A. B., in the parish of in the county of Cornwall, Esq., do hereby give and grant unto C. D., of the parish of , in the said county, miner, free liberty, license, and authority to dig, search, and work for tin, lead, and copper, and all other ores, metals, and minerals in and throughout all that part of the estate of , situate in the parish of , in the said county, now in the occupation of the said A. B., and of , as his tenants, bounded [Mem.—Set out boundaries carefully], as far as the right of the said A. B. extends, for the term of twelve calendar months from the date hereof, excepting unto the said A. B., his heirs, and assigns, all stone and truss, with liberty to carry away the same; the said C. D. and his co-adventurers yielding and paying unto the said A. B., his heirs, and assigns, one full seventeenth part or share, in money, of the produce arising from the sale or disposal of all tin and tin-stuff, copper, lead, and other ores, metals, and minerals which shall be found, dug, or raised within the limits aforesaid, provided that the said C. D. shall immediately commence, and during the said term, continue well and sufficiently to search within the said limits for ores as aforesaid; and also at the end of the said term making full and ample compensation to the said A. B., his heirs, and assigns, and the tenants or occupiers for the time being, for any damage done to the said premises, or their or either of their cattle; and at the end of the said term he will abandon, quit, or deliver up the said premises to the said A. B.; and fill up, at his own expense, all such workings, shafts, and pits as he shall sink on the premises, and which the said A. B. shall require to be filled up; and that the said C. D., his workmen, or others working on the said premises, after the expiration of the said term, without a grant, as hereinafter mentioned, shall be deemed wilful trespassers, and punished as such at petty sessions; and it is hereby agreed by and between the said parties hereto, that at the end of the said term the said C. D. shall have a sett or grant between the bounds and limits aforesaid from the said A. B., his heirs, or assigns, if then required by the said C. D., which grant shall contain such usual covenants, clauses, exceptions, and provisions as apply to mining, with such other conditions and clauses as may be agreed on between the said parties hereto: provided also that such a company of adventurers as the said A. B., his heirs, or assigns,

shall approve of, be then formed, and engage to work the ground with effect, and execute a counterpart of such sett or grant, and pay £21 for the same, which shall be prepared at the office of , at the expense of the said .

Dated this day of .

II.—MEMORANDUM OF VIVA VOCE ARRANGEMENT AS TO MINING LEASE.

Mining lease by way of license for 31 years, with power of immediate surrender. One-eighteenth dues of all ores, &c., at mine, or equivalent in cash, at option of lessor. Covenant to bind the lessees to spend, on the average of any consecutive six months, at least £ per month, after the first six months, and in the mean time £ per month for actual manual labour and materials actually *employed* in searching, opening, and working mines, quarries, or pits, above or under ground, on the lands, exclusive of any remuneration for agents or management.

Written guarantee of person of known solvency, to be approved by lessor, for the performance of the last covenant; and if the said £ and £ , respectively, are not spent in work as aforesaid and materials for the same, then for the sum total to which that amounts, or the unexpended difference thereof, to be paid to the lessor. But in the case of unavoidable influx of water, unreasonable strike of workmen, public disturbance, or other unavoidable cause of suspension of mining operations, the said sum of £ per month to be paid monthly into bank, into joint names of lessor and lessee, so as to form a fund for the more effectual working of the mine as soon as possible. Correct plans of the mines and discoveries, and books effecting royalties, and monthly expenditure up to the stipulated amount, to be open for examination by lessor, or his agents; and vouchers, verified by declaration, if required, to be shown. In case of fraud, the lease to be void, but without prejudice to lessor's remedies.

No common miners' dwellings; surface damage at agricultural value, unless near the principal dwelling-house; in which case the "ornamentals" damage to be valued in the usual way.

Service of notice, &c., upon Messrs. Smith, or such Dublin solicitor as lessee shall from time to time nominate, in writing, to the lessor, to be sufficient service. Lessor to reserve power to raise stones, flags, and earth for building, fencing, road-making, or other ordinary purposes, not commercial. Lease to contain the usual covenants,—such as power to lessor to revoke in case of non-performance of lessee in covenants; power to enter mine, inspect and take measurements, &c., of distress and entry, &c., and for quiet enjoyment by lessee; power for water, except that now enjoyed by E. F. and G. H., and necessary engines, except dwelling-houses for common miners, as aforesaid.

Lease to be drawn by lessee, and approved of by lessor, each at his own expense. Works to be begun on or before the of 18

Ores now lying on bank to belong to lessor. If lessee should take any lands adjoining, he is to be at liberty to *work them by approaches driven through these lands;* but so as that none of the waste nor water from the other "limits" shall be deposited on or injure these limits.

III.—MINING LICENSE FOR THIRTY-ONE YEARS, FROM THE 1ST DAY OF JANUARY, 1861.

THIS INDENTURE, made this 1st day of February, 1861, betweeen A. B., of , in the county of , of the one part, and C. D., of , in the county of , of the other part, witnesseth that in consideration of the rent, covenants, and agreements hereinafter mentioned, he, the said A. B., doth give and grant unto the said C. D., his executors, administrators, or assigns, full, sole, and exclusive liberty, license, power, and authority to dig, open, work, mine, and search for copper, copper ore, and all other ores, minerals, mineral substances, clays, earth, stones, slates, rocks, and all other substances whatsoever in the nature of mines or minerals of commercial value, whether open or unopened, which may be found to be in, under, or upon, within or throughout, ALL THOSE the townlands of Blackacre and Whiteacre, in the barony of , and county of , in Ireland; all which said lands and premises are hereinafter referred to under the denomination of "Limits;" and all the ores, metals, and minerals, stone, clay, and other underground produce, as aforesaid, there found to raise and bring to grass, and there to spall, dress, cleanse, manufacture, and make marketable, and to carry away, and convert to his, her, or their own use and benefit, subject to the reservations and covenants hereinafter contained; and within the limits aforesaid to dig, make, and drive such adits, shafts, pits, levels, drifts, wheel-pits, dams, leats, pools, ponds, or watercourses, roads, tram-roads, or inclines, dressing floors, and store-banks, or to divert those now existing; but so as not to injure or affect the water-power now legally used and enjoyed by E. F. and G. H.; and to make such erections and buildings in the limits aforesaid as shall or may be deemed necessary or advisable for the several purposes aforesaid, or for the more effectual working, opening, and management thereof, except dwelling-houses for common miners, as hereinafter mentioned; and also to use all such adits, shafts, pits, levels, drifts, wheel-pits, and leats, and other works and conveniences in, upon, and within the said limits as shall be necessary or proper for approaching and effectually and conveniently working the mines and lodes in any adjoining limits in which the said C. D., his executors, administrators, or assigns may hereafter procure a license to work; subject, however, to the covenant and agreement hereinafter contained as to the deposit of waste earth, clay, soil, or other substance raised from adjoining limits, and as to the injurious influx of water from adjoining limits. Excepting, nevertheless, and reserving unto the said

A. B., his heirs, and assigns, liberty at all reasonable times, for themselves or their agents, to go down into, examine, and measure all or any of the workings of the said mine or works intended to be carried on within the said limits, and for that purpose to use, free of any charge, all the conveniences, ladders, buckets, kibbles, ropes, tackle, whims, and other things then and there being. And also excepting and reserving to the said A. B.; his heirs, and assigns, full liberty to dig, search for, and raise such stones, flags, and earth within the limits aforesaid as may be convenient or necessary for building, fencing, road-making, or other purposes of the same nature, not being commercial purposes. To HAVE and TO HOLD, use, exercise, and enjoy the several liberties, licenses, powers, and authorities mentioned and intended to be hereby granted unto the said C. D., his executors, and administrators, for the full term of thirty-one years, from the 1st day of January, 1861, subject, nevertheless, to the powers to determine same hereinafter contained. Yielding and paying, setting and keeping apart, laying out and delivering, unto the said A. B., his heirs, and assigns, during the said term $\frac{1}{18}$th part (the whole into 18 equal parts to be divided) of all such copper, copper ore, and other ores, minerals, or fossil substances, clays, earths, stones, slates, rocks, or other substances whatsoever in the nature of minerals respectively, of the fair average quality of the remaining $\frac{17}{18}$ths thereof, as shall at any time be dug, broken, raised, or gotten within the limits aforesaid at the scales of the mine and at the surface; and shall weigh and store same free and clear of all costs, charges, and expenses whatsoever. Or if the said A. B., his heirs, and assigns, shall at any time or times during the term hereby granted desire to have the value of the hereinbefore reserved $\frac{1}{18}$th part of said ores and substances in money, then and in every such case, and so often as the said A. B., or his heirs and assigns, shall so desire it, yielding and paying, in lieu of the above reserved $\frac{1}{18}$th part of said ores and other minerals, or fossil substances, such sum or sums of money as shall be equal to the full value of the above reserved part or parts of said substances when brought to the surface, free from all costs, charges, and expenses whatsoever, the said $\frac{1}{18}$th part, share, due, royalty, dish, or sum of money, hereinbefore reserved, to become due and payable, and to take place twice in each year during said term, that is to say, on every 1st day of May, and 1st of November, the first of such days to be the 1st day of November next ensuing the date hereof, or oftener, if and as often as any of such ores, metals, minerals, clays, stones, slates, or other substances as aforesaid, shall be in large quantity on the floors of the mine, and the parties hereto shall mutually agree thereto. And the said C. D. doth hereby, for himself, his heirs, executors, and administrators, covenant, promise, and agree with and to the said A. B., his heirs, and assigns, in manner following:—that is to say, that the said C. D., his executors, administrators, and assigns, shall and will, during the continuance of the said term of thirty-one years, well and truly weigh, set, and keep apart, lay out, store, and deliver, or pay, or cause to be weighed, set, and kept apart, laid out, stored, and delivered, or paid unto the said A. B., his

heirs, and assigns, or his or their agent, or toller for the time being, the full and just $\frac{1}{18}$th part, share, due, royalty, or dish, hereinbefore respectively reserved in manner aforesaid, of the fair average quality of the remaining $\frac{17}{18}$ths thereof; or, at the election of the said A. B., his heirs, and assigns, thoroughly dress, and render merchantable, and transport to market, and sell the said $\frac{1}{18}$th part at reasonable charges, and well and truly pay the produce of the respectively reserved $\frac{1}{18}$th part share and royalty, or dish, in money at such best price as the same can from time to time be sold for, first deducting therefrom all reasonable expenses and charges for dressing, rendering merchantable, transporting to market, and selling the said $\frac{1}{18}$th part, and also shall and will give four days' notice in writing to the said A. B., his heirs, or assigns, or the agent or toller of the time, of the weighing, or division of the copper, copper ore, and other metals, ores, and minerals or fossil substances as aforesaid, to be raised and gotten by virtue of these presents; and shall and will pay all rates, taxes, and assessments, which now are, or which at any time hereafter during said term shall be taxed, charged, assessed, or imposed upon the said ores, metals, or mineral substances, or upon the money which shall arise from the sale thereof, or upon the said mine; and also shall and will, at all times during the said term of thirty-one years, subject to the power of determining the same hereinafter contained, well and effectually, and without intermission, work the "limits" aforesaid, at all usual working time, with a sufficient number of able working miners, and also by all other ways and means in approved use, and according to the rules and practice of good miners, so that the whole of the ground within the limits aforesaid may be fully and effectually explored, tried, and worked; and for that purpose shall and will, exclusively of and in addition to the wages or remuneration of overseers, mine-agents, or management, expend during the first twelve months of said term, for actual manual labour and materials actually employed in searching, opening, and working the mines, quarries, or pits, above or underground within the said limits, and in raising such minerals and fossil substances as aforesaid, such sum of money as will be equivalent to the sum of £ per month; and from and after the expiration of twelve months from the said then that the said C. D., his executors, administrators, or assigns, shall and will expend, in manner aforesaid, in every succeeding six months, such sum of money as will be equivalent to the sum of £ per month, and shall and will on every 1st day of May, and 1st day of November, pay, or cause to be paid, to the said A. B. his heirs and assigns, such portion of the said sums equivalent to £ per month, and £ per month respectively, as shall not within the respective periods be expended in actual manual labour for the purposes aforesaid, or in materials actually employed in searching, opening, or working as aforesaid; or in case the said sums shall not be expended to the full amount by reason of unavoidable influx of water, unreasonable strike of workmen, public disturbance, or other unavoidable cause of suspension of work, shall and will, in every such case, and so often as the same shall happen, lodge in the Bank of Ireland, or in the Royal

Bank at Dublin, so much of the said several and respective sums as shall not for the reasons aforesaid, or any of them, be expended in manner aforesaid, in the joint names of the said A. B., his heirs, or assigns, and of the said C. D., his executors, and administrators, or in the names of such person or persons as they shall mutually nominate, and to be invested in such securities as they shall mutually agree upon, such sum in addition to the subsequently accruing average monthly expenditure to be expended on the said mines in manner aforesaid, when such temporary cause of suspension of working shall have ceased, and each of the said parties shall and will make and join in all drafts and orders upon such bank for such purpose; and also shall and will, from time to time, during the said term, cause true and faithful accounts to be entered in a book or books, to be kept for that purpose in the counting-house, or some other convenient place, within, near, or adjacent to the said limits, of all the ores, metals, minerals, stones, clay, or other mineral substances or produce as aforesaid, which shall be raised and gotten within the said limits during the said term, and of all sales thereof, and of all moneys expended in the labour and materials aforesaid; and shall and will on the 1st day of May, and 1st day of November in each year, and every year during the said term, make and deliver, or cause to be made and delivered, unto the said A. B., his heirs, and assigns, or his or their agent, in such tabular or other form as the said A. B., his heirs, or assigns, shall from time to time require, a full, true, just, and fair account in writing of all the ores, metals, minerals, earths, clays, stones, and other substances of commercial value raised or gotten within said limits, and of all the moneys received by the said C. D., his executors, administrators, or assigns, or fellow-adventurer, on account thereof, and particularly of all moneys expended in the actual manual labour, and in the materials actually employed as aforesaid, up to the said average monthly expenditure, the whole of said account being for the six months next preceding, and shall and will, when thereto required, upon one week's previous notice being given in manner hereinafter provided, produce the said book or books of account, and the vouchers and other documents relating thereto, duly verified by statutory declaration, if required, to the said A. B., his heirs, and assigns, or their agents or nominees, or before any court of law or equity, or before any arbitrators to whom disputes may be referred; and shall and will, at all reasonable times, permit and suffer the said A. B., his heirs, and assigns, or his or their stewards or agents for the time being, to inspect the same accounts, and to take extracts therefrom, and to make copies thereof; and also that he the said C. D., his executors, or administrators, or assigns, shall not nor will mix any of the ores, metals, minerals, stone, clay, or other mineral substances, or produce as aforesaid, with them of any other mine, without the leave in writing of the said A. B., his heirs, or assigns; and shall and will, at all times during the said term, keep all the engine-houses and other buildings which may be hereafter erected on the said "limits," in substantial repair, and also repair, keep open, and support all adits, shafts, pits, drifts, leats, and channels already or hereafter to be made

within the limits aforesaid, with proper and convenient timber, fixed stemples, props, and other contrivances, unless the removal of same, or the filling in the same be required for the more effectual working of the said mines, quarries, or pits, and the same severally in such repair shall and will, at the expiration or other sooner determination of the said term, quietly and peaceably yield and deliver up, together with such removable engines, machinery, and other materials thereunto belonging, as the said A. B., his heirs, or assigns, shall by notice in writing given to the said C. D., his executors, administrators, or assigns, in the manner hereinafter mentioned, within one month next after having received from him or them a notice in writing of the intention of the said C. D., his executors, administrators, or assigns, to remove the same, choose to take, the said A. B., his heirs, and assigns, paying within three months from the date of the said notice, so to be served by the said A. B., his heirs, or assigns, as aforesaid, a reasonable price for the same, or for such parts thereof as they shall so choose to take as aforesaid, but so that they shall not take any part of said engine without taking the whole thereof, such price to be fixed, if necessary, by two out of any three indifferent persons, one to be chosen by the said A. B., his heirs, and assigns; another by the said C. D., his executors, administrators, and assigns; and the third by the said two persons so to be chosen as aforesaid or in case of either of said parties omitting, within one week after being called on so to do by notice in writing by the other of them, to appoint a referee for the purpose aforesaid, then as shall be fixed by the sole referee appointed by the other of said parties as aforesaid, provided always that the said C. D., his executors, or administrators, shall not be bound to repair any buildings which shall be necessarily destroyed or impaired in taking down or removing such engines (if any) as the said A. B., his heirs, or assigns, shall not choose to purchase. And further, that the said C. D., his executors, or administrators shall not remove any of the said engines, machinery, or materials, without first giving such notice as last aforesaid; and also shall and will permit the said A. B., his heirs, or assigns, agent, or steward, servants, or workmen, or other persons authorized in writing by the said A. B., his heirs, or assigns, for the time being, at any time or times during term hereby granted, to go down into, inspect, examine, and measure all or any of the adits, shafts, and other works already or hereafter to be dug, wrought, driven, sunk, or made within the said "limits," and for that purpose to make use of the tackle, buckets, ropes, kibbles, or any other convenience, when and so often as they or any of them shall think fit, but so as not unreasonably to interfere with the prosecution of the works, free of all charge for the same, and shall then and there disclose to him or them all new discoveries or indications of minerals; and also shall and will at all times during the said term keep, and at the end or other sooner determination thereof deliver up, all the shafts, pits, trenches, or water-courses which shall be made, dug, or sunk within the said "limits," well and effectually fenced off, so as to prevent cattle from falling

therein, so far as can be done without obstruction to the fair and necessary use of the same; and also that the said C. D., his executors, administrators, and assigns, shall and will at his and their own expense provide and keep in the counting-house of the said mine full and true diallings and sections, on a scale of not less than one inch to eight fathoms, of the said mine, and of all deposits, courses, lodes, and veins discovered or worked, and shall and will from time to time add to and correct the same up to the first day of the preceding quarter, and shall and will at all reasonable times permit and suffer the said A. B., his heirs, and assigns, or his or their agents or servants, to inspect the same, and to make tracings and copies thereof; and also shall and will lay aside in heaps for the occupiers of the said "limits," or permit them to remove for their own use, all the meat, earth, and soil which shall be dug up in the prosecution of the said adventure, and shall not within six months thereafter lay any ores or rubbish thereon, and shall and will do as little damage or injury to the surface of said lands, or to any dwelling-house, office, or tenement, or premises within the said "limits" as is practicable in the exercise and enjoyment of the liberties and authorities hereby granted; and shall and will, upon reasonable notice in that behalf, make full compensation at agricultural value to the respective tenants or occupiers for the time being of said lands for all material or agricultural damage, and to the said A. B., his heirs, and assigns, for all damage or injury in the nature of ornamental as well as agricultural damage or injury to the principal dwelling-house within the said "limits," arising from any neglect of the said C. D., his executors, administrators, or assigns, or any of them, or any of their agents, servants, or workmen, in the exercise of any of the liberties, licenses, powers, and authorities by these presents granted, such compensation to be fixed by any two or three indifferent persons, or by a sole referee, as the case may be, to be chosen respectively as aforesaid; and also shall and will at the end or other sooner determination of said term make full and ample satisfaction to said A. B., his heirs, and assigns, for one-half of all the permanent damage or injury which may have been done to all or any part of said lands and hereditaments within said "limits" by reason of the exercise of the liberties and authorities hereby granted, or in anywise relating thereto, without setting off against or deducting anything whatever therefrom; and shall also make full and ample satisfaction to the said A. B., his heirs, and assigns, for the other half of the said permanent damage or injury, but shall be at liberty first to set off against or deduct from the said second half, moiety, or residue, all moneys actually paid to the said A. B., his heirs, or assigns, in respect of royalties, or so much of said moneys as may be sufficient to balance the demand of the said A. B., his heirs, and assigns, in respect of the said second half, moiety, or residue of the said permanent damage, the amount of such satisfaction to be ascertained and estimated by such reference as aforesaid; and also shall and will, in case of the said A. B., his heirs, or assigns, having occasion to bring an action at law or suit in equity in relation to the said mines or connected therewith, from time to time and

at all times hereafter during the term hereby granted, and at any time after the expiration or sooner determination thereof while any of the covenants herein on the grantee's part contained shall remain unperformed, deliver or cause to be delivered to the said A. B., his heirs, and assigns, or his or their agent or steward for the time being, within twenty-one days after notice in writing in that behalf shall have been given or left to or for the said C. D., his executors, or administrators, or assigns, in the manner hereinafter provided, a true and perfect list in writing under the hand or hands of the said C. D., his executors, and administrators, of all such persons as shall have been adventurers therein during any period or periods of the time between the commencement of the said term, or the date of any previous like notice, as the case may be, and the day of the date of such current notice, which shall be specified therein, together with the then last known place of abode and additions of such adventurers, and also the shares and interests held by them respectively in said mine during the said period or periods of time. And further, that the said C. D., his executors, administrators, or assigns, shall not nor will prejudice, affect, or in any manner interfere with the water-power, water-courses, and rights of water, or other easement now legally used and enjoyed by E. F. and C. H., and also that he, the said C. D., his executors, administrators, or assigns, shall not nor will throw, deposit, or place on any land within the limits aforesaid any waste earth, clay, soil, or other substance raised or taken from any adjoining limits or other lands, and shall not nor will make or permit any injurious influx of water from adjoining limits or adjoining or other mines or lodes; and shall not nor will erect, or cause or permit to be erected or built, any dwellings, or houses, or buildings, as residences for common miners or mining labourers, or permit any buildings now on said lands, or hereafter to be built on said limits, and the property of the said C. D., his executors, administrators, or assigns, to be used as a residence or residences for common miners or mining labourers, save for a sufficient number of watchmen, such number not to exceed three. Provided always, and it is hereby declared and agreed, that any notice to be served upon the said C. D., his executors, administrators, or assigns, under the provisions of these presents, or any notice or process at law or in equity for the purpose of or preliminary to any action at law or proceeding in equity against the said C. D., his executors, administrators, or assigns, or for any other purpose, which shall be served upon the said C. D., his executors, administrators, or assigns, or upon the purser, manager, or principal captain, of the mine or mines within said limits, either personally or by leaving same at his or their respective dwelling-house or dwelling-houses for the time being, or at or upon the counting-house of the said mine or mines, or which notice or process shall be affixed in some conspicuous place within the limits aforesaid, shall be deemed sufficiently served for all intents and purposes whatsoever: provided always that a true copy or duplicate of the said notice or process shall be also served upon Peter Smith, of the city of Dublin, solicitor, or upon such other practising solicitor of Her Majesty's Courts of Justice in Ireland, and resident in the city of Dublin, as

the said C. D., his executors, administrators, or assigns, shall notify in writing to the said A. B., his heirs, or assigns. Provided always, and it is hereby declared and agreed by and between the said parties hereto, that if the said one-eighteenth part, share, or proportion of said produce hereinbefore reserved shall not be duly weighed and set and kept apart, laid out, and delivered as aforesaid, or within twenty-one days after the days hereinbefore appointed for that purpose, or the money value thereof, at the election of the said A. B., his heirs, and assigns, duly paid as aforesaid, then, and so often as the same shall happen, it shall and may be lawful to and for the said A. B., his heirs, and assigns, to enter upon the lands within the limits aforesaid, and any work or works to be carried on therein, or into any part or parts thereof, and to distrain all or any of the engines, tools, tackle, improvements, materials, or other chattels or effects then and there being, and to dispose of the distress or distresses then and there found as a distress for rent in arrear, to the intent that thereby or otherwise the said proportion, part, or share of said produce, or at the option of the said A. B., his heirs, and assigns, the value thereof in money, and all costs and expenses occasioned by the non-delivery or non-payment thereof, shall be fully satisfied. Provided always, and it is hereby declared and agreed by and between the said parties hereto, that if the said C. D., his executors, administrators, or assigns, shall break or not perform all or any one or more of the covenants and agreements hereinbefore contained on his or their parts to be performed, observed, and kept, then and in any of those cases it shall and may be Lawful to and for the said A. B., his heirs, and assigns (but without prejudice to any right of action or other remedy which may have previously accrued in respect of the breach of any of the covenants and agreements hereinbefore contained), into and upon the said mines, or quarries, or works, or any part thereof in the name of the whole, to re-enter, and the same to have again, repossess and enjoy as if these presents and the license herein contained had not been made; and thereupon, or at any time thereafter, by deed under his or their hand and seal, to revoke and make void this present license, and thereupon all grants, setts, licenses, powers, and authorities herein contained and hereby granted shall cease, and be utterly determined as well in equity as at law, anything herein contained to the contrary notwithstanding, save and except for the purpose of enforcing any right of action which shall or may have accrued to the said A. B., his heirs, or assigns, or to the said C. D., his executors, or administrators, by reason of the breach of all or any of the covenants and agreements herein contained. Provided also, that it shall and may be lawful for the said C. D., his executors, administrators, and assigns, at any time after the expiration of six months from the   to abandon and give up the further prosecution of the mines and works intended to be carried on under the authority hereof, and to give up and surrender the license hereby given; and upon such surrender being duly made by delivering unto the said A. B., his heirs, or assigns of this present license, the said license, and all the covenants, conditions, and agreements herein contained, shall cease and be determined as well in equity

as at law, save only for the purpose of enforcing any right of action which may have accrued to either of the said parties hereto by reason of the previous breach of any of the covenants, conditions, and agreements herein contained. AND HE, the said A. B., for himself, and for his heirs and assigns, doth hereby covenant with the said C. D., his executors, administrators, and assigns, that under and subject to the due performance of the covenants, conditions, and agreements herein contained, the said C. D., his executors, administrators, and assigns shall quietly and peaceably enjoy the liberties, licenses, powers, and authorities hereby granted for the term, and in the manner aforesaid, without the hindrance or denial of the said A. B., his heirs, or assigns, or any other person or persons claiming or to claim through, under, or in trust for them or any of them. In witness whereof, &c.

XII.—On the Granitic Rocks of the south-west of Donegal, and the Minerals therewith associated. By Robert H. Scott, M. A.

Read November 13, 1861.

The granites of Ireland are found in four distinct areas, the first of which is best known as the Leinster granite; the second is that which forms the Mourne, Dundalk, and Newry mountains; the third is that about which I purpose to say a few words; and the fourth is that in the counties of Mayo and Galway. The types of the three first granites are totally distinct from each other. The Leinster granite is composed of white orthose, margarodite, and black mica, and transparent quartz. The Mourne granite contains two trisilicated felspars, pink orthose, and white albite, with black mica, and smoke quartz. The Donegal granite has a constitution more closely resembling that of some Scandinavian granites than that of any other rocks I am at present acquainted with. Its felspathic portion consists of a mixture of pink orthose and oligoclase. The latter of these felspars, so characteristic a constituent of the Norwegian granites, was first described as a British species by Professor Haughton, in the course of last year.

This mineral, whose existence in granite is often ignored by English geologists, inasmuch as they always define granite to be a trisilicated rock, is very common in the plutonic rocks of the Continent. In the original definition of granite given by Professor Gustav Rose in the first volume of the Journal of the German Geological Society, where he draws a distinction between two types of that rock, called by him *Granite* and *Granitite*, he assigns the following constitution to the two subdivisions, characterized respectively by their containing, in the first case *two*, in the second *one* type of mica.

Granite consists of	*Granitite* consists of
Orthose (white).	Orthose (red).
Oligoclase (in small quantity).	Oligoclase (abundant).
Quartz.	Quartz.
White mica.	Greenish mica.
Black mica.	

As regards the above definition, I may be allowed respectfully to submit that oligoclase appears to be sometimes absent. It has not been proved *by actual analysis* to be present either in the granite of the main chain of Leinster, or in that of the Mourne mountains. The examination of these districts has been carried out by our President, and published by him in the Journal of the Geological Society of London, vols. xii. and xiv., and in the Transactions of the Royal Irish Academy, vol. xxiii. In these papers he states that the felspathic portion of the Leinster granite consists of crystallized orthose and a felspar paste which has a constitution more closely resembling that of pericline than of oligoclase; that of the Mourne mountains appears to consist of a mixture of orthose and albite.

Having received, last spring, a collection of Donegal granites from Mr. W. Harte, C. E., the county surveyor of the western district, Professor Haughton and I proceeded last July to examine that district for ourselves; and we soon found that it possessed more interest in this respect than any other part of Ireland, not excepting the Mourne mountains. Professor Haughton was previously acquainted with the north-eastern part of the county of Donegal.

By a reference to Sir R. Griffith's map, it will be seen that there are in Donegal two distinct tracts, coloured lake; the smaller of these is isolated, and is the granite of the gap of Barnesmore; the axis of the other runs in a N. E. direction from Lettermacaward to Glen, along the valleys of Gweebarra and Glenveagh, and it is prolonged so as to appear in isolated patches at Unismenagh, near Dunaff Head, and at Ardmalin in Innishowen. This is the granite which I call the typical Donegal granite; and veins of this granite are found penetrating the gneiss in the extreme south of the county, and at Castle-Caldwell, in the county Fermanagh, on the shore of Lough Erne.

Our tour commenced at this point, where considerable attention has been recently drawn to the felspars, from the fact that some of the veins just alluded to are almost entirely composed of pink orthose, in a state of such purity as to induce the establishment of a factory for the manufacture of china. At Castle-Caldwell itself we only find veins of this orthose granite, which is there accompanied by large plates of black mica and margarodite, with considerable quantities of schorl,—the black mica assuming frequently a greenish hue, from incipient decomposition. At Garvary, about a mile from this, we find veins of a coarse crystalline granite, in which the oligoclase is clearly to be distinguished by its waxy lustre and imperfect cleavage, compared with that of orthose. The white mica is nearly absent, and small garnets are not uncommon. This granite contains iron pyrites and molybdenite both in such quantity, that the veins in which they occur were opened for some distance in search of a lode, the molybdenite being supposed to be galena.

About five miles to the north of this locality, at the Black Gap, near Pettigo, the granite assumes a very remarkable appearance, some of the veins seeming to be almost entirely composed of a very pale orthose, and large plates of greenish-black mica. There would be difficulty

in recognising this granite at once, were it not that in some specimens of Castle-Caldwell granite, in my possession, a tendency to this structure is already observable.

We entered on the granite area, properly so called, at Ardara, its S. W. extremity, and found at this point that the appearance of the rock differed somewhat from that which it presents towards the centre of the district, in some respects resembling a syenite to which I shall hereafter direct your attention.

In fact, its analysis—

SiO_3	55·20
Al_2O_3, . . .	19·28
Fe_2O_3, . . .	6·08
FeO, ...	0·46
MnO, ...	0·96
CaO, ...	5·08
MgO, ...	8·66
NaO, ...	4·63
KO, ...	3·17
HO, ...	0·64
	99·16

shows that it is, properly speaking, not a granite at all. The large proportion of lime, magnesia, and alumina, and the small quantity of silica, indicate that it is not a true orthose granite. The granite at Doocharry Bridge, a few miles from this locality, contains 72 per cent. of silica, and 15 of alumina. A similar variation in the constitution of granite, as it approaches the limits of its area, has been frequently observed in other localities. At Ardara it contains the two feldspars, orthose and oligoclase, which are clearly to be distinguished by their difference of lustre, and in addition small crystals of sphene, a mineral which appears to be even more common in the granite of Donegal than in that of Newry, in which it has been long known to exist.

From Ardara the road lay by Glenties and Doocharry Bridge to Dunglow. On crossing the ridge which forms the south side of the Gweebarra valley, at a place called Shallogan Bridge, we found some large and well-coloured garnets in the granite, which here puts on an appearance like that which it has at Castle-Caldwell, consisting of red orthose, black and white mica, and quartz, the oligoclase disappearing. However, at Doocharry Bridge, a few miles further on, both feldspars are clearly perceptible in the granite, although the rock is very fine-grained.

At Dunglow the granite is remarkable for its containing, in one hill called Sheskin-na-ruan, a mile north of the town, on the road to Annagary, beryls in such quantity as almost to deserve the name of beryl granite. The beryls are blue, and in some cases transparent, though in this particular they come far behind the specimens from the Mourne mountains. However, some very fine slabs of beryl in quartz have been

obtained, which are to be seen in most of the museums in this country and in England.

In the neighbourhood of Dunglow, on the northern flank of the granite, we find a considerable development of primary limestone, which has been metamorphosed by the action of the granite, and rendered highly crystalline. This change has been accompanied by the formation in the limestone of garnets and idocrase in great abundance.

At this point, Annagary, the granite itself resumes the coarse-grained appearance which it possesses at Garvary, the crystals of oligoclase being as easily distinguishable as those of orthose. The fact that at two points so widely distant as Annagary and Castle-Caldwell, separated from each other by a great mass of metamorphic rocks, we find the same peculiar type of granite, which type is also recognisable in the granites of Doocharry Bridge and to a certain extent in that of Ardara, seems hardly to leave a doubt that our statement of this being the typical granite of the county is correct.

At Annagary itself we discovered several other minerals, among which I may mention black mica, in great abundance, and sphene. The latter has been alluded to before as occurring in the granite of Ardara. However, at Annagary we found a rock, which we have termed provisionally sphene rock, and which is composed of feldspar, with a green mineral, probably epidote, and contains a very large quantity of sphene. This sphene rock is, as far as we could ascertain, the next bed to the limestone wherever this latter occurs close to the granite, and appears to have an intimate connexion with the limestone.

It is doubtless known to many members of the Society, that about six years ago Professor Haughton discovered a syenite at Carlingford, the feldspar of which is anorthite. This rock he has, in my opinion, succeeded in tracing to the fluxing of the granite of that district by means of limestone. This rock appears at several points in the neighbourhood of Carlingford, but only in places where the granite has pierced the carboniferous limestone. In Donegal, where a quantity of primary limestone is disseminated through the mica schist, a syenite passing at times, like that of Carlingford, into hornblende rock, appears at several points over the whole of that part of the county which is in the immediate vicinity of the granite, but not in contact with the limestone. The feldspar of this syenite is oligoclase, a mineral which would result from the admixture of a less amount of basic rock with the granite than is requisite to produce anorthite. This syenite, which we call the oligoclase syenite, has another point of connexion with the granite, which is that it contains sphene.

We have adopted the term syenite for this rock, as that name appears to possess a higher antiquity than any other for the same rock. In Kirwan's Mineralogy, published in 1810, we find, at page 297, vol. i., the following definition:—" *Sienite.*—An aggregate of quartz, hornblende, and felspar, or of quartz, felspar, hornblende, and mica, appears to Mr. Werner to be of later formation than the mere aggregate, of which hornblende is not a constituent part: hence he distinguishes it at first by

the name of '*grunsten*': afterwards, however, he found the name '*sienite*' more proper, it having been already used by Pliny to denote a similar substance."*

The sphene rock does not contain oligoclase, as its felspathic portion is found to be orthose.

SiO_3, ...	73·04
Al_2O_3, ...	15·20
CaO, ...	1·84
MgO, ...	0·09
NaO, ...	2·88
KO, ...	7·32
	100·37

This seems to afford a strong confirmation of the theory which I propose, viz., that the granite of Donegal has been formed from materials existing on the spot, without actual fusion. The sphene rock is in actual contact with the garnet limestone wherever we find these rocks. It is remarked that the presence of the garnets in the limestone makes it run to glass in burning it for lime, therefore we may be allowed to conclude that it never was exposed to a sufficient heat to melt it. If the rock were not exposed to such a heat, the lime of the garnets and of the limestone itself could not have exerted sufficient influence on the orthose to

* This rock appears to have the same constitution as the "diorite" of some modern petrologists: the reason that I have not adopted this name is, that the meaning of the term does not seem as yet to be quite settled. This will be seen from a comparison of the definitions of it given by a few of the authors on the subject. G. Rose (Pogg. Ann. xxxiv. p. 2) says it is "a granular mixture of albite and hornblende." This definition has passed into the English text-books, and is adopted by Lyell. Delesse (Bull. de la Soc. Geol. de France, 2nd Series, tom. xv. p. 776) says it is "composed essentially of anorthose and hornblende." Senft (Classification der Felsarten) adheres to Rose's definition at page 58, and at page 242 deserts it, saying that albite is often replaced by oligoclase, and quotes, in confirmation of this statement, the opinion of G. Rose, expressed at a later period, that albite only occurs in the druses, and that oligoclase is the essential constituent of the rock. Blum (Lithologie, p. 153), and Rath (Gesteins-analysen p. xlii.) state that its felspathic portion is oligoclase. Several of the rocks which were originally described by G. Rose as diorite, have been since found to contain a feldspar which is not albite, e. g. the diorite from near Bogoslowsk in the Ural, the feldspar of which was examined, at his request, by both M. Potyka and myself, and was found to be anorthite. The names which have been adopted by Professor Haughton and myself for such rocks appear to agree with the oldest definition of all, that of Werner; the presence of hornblende being the circumstance which confers on the rock its distinctive character. The different varieties may then be simply characterized by their feldspathic element, as orthose-syenite, oligoclase-syenite, anorthite-syenite, &c., &c., as the case may be. If augite occurs, its presence may be indicated in the name of the rock. Such a nomenclature has the merit of introducing no terms which do not already exist in all text-books, as the name of the rock indicates its composition. The universal adoption of an analogous compound nomenclature in organic chemistry is sufficient to prove the utility of such a plan. We may not agree with all the conclusions of Werner, but it is surely well to preserve his names, as far as they are not contradictory to subsequent experience.

change the composition of that mineral to oligoclase. We have not found oligoclase in contact with limestone; where the oligoclase occurs, the limestone has been destroyed. At Dunlewy the limestone is in immediate contact with the granite, and the latter consists nearly entirely of orthose. It would appear that wherever the syenite exists, sufficient heat has been present to allow of mutual chemical action between the limestone and the granite.

The connexion between the granites, syenites, and hornblende rocks on the one hand, and the limestones and mica schists on the other, is one which will require a very careful chemical examination; this we hope to carry out, to some extent, in the course of this winter, as far as our specimens will serve us. We have as yet found this syenite lying along the edge of the granite, and at some points, as at Ardara, the granite assumes a syenitic appearance, hardly to be distinguished from the Black Gap syenite.

Before I leave the question of these rocks, I might direct your attention more closely to the hornblende rock. This is usually accompanied by black mica, and forms a rock found also at West Aston in Wicklow, and Glin in Carlow. The connexion between hornblende and black mica is striking, as they pass one into the other by apparently insensible gradations. On visiting last year the cabinet of Freiberg, in Saxony, I found there the original specimenn on which Soltmann founded the species called by him "lepidomelane"; this came from Persberg, in Wermland, and was hardly to be distinguished from a nest of our black mica, such as it occurs in the granite of Newry; it too contained large crystals of hornblende.

The natural association of minerals is a point in petrology which appears to deserve more attention than has been hitherto paid to it by English geologists. Miners are accustomed to attend to the indications afforded by associated minerals, and surely similar analogies may be expected to hold among the siliceous minerals.

As to the constitution of the granite, as a whole, the first point which I wish to note about it is that it presents no appearance of being of a purely igneous origin—in fact, the evidence seems to point out a metamorphic origin for it. It is thoroughly gneissose in its character, and lies in thin beds, corresponding to the bedding of the stratified rocks of the country: however, the strongest evidence which I can offer on this point is the fact, that far within the limit of the granite at Glenleheen we found isolated patches of metamorphic rocks, not lying *on* the granite, but *in it*, their bedding being nearly vertical. The two points at which this occurs are not very distant from each other, and lie about 1½ miles in a straight line from the edge of the granite; they were both pointed out to us by Mr. Ethelstan Blake, a mining engineer, who was at the time in the neighbourhood. At the first point the patch is about 50 feet thick, and consists mainly of slaty rocks: however, here we found the garnet limestone recognisable, but considerably altered, a large quantity of chalcedony being found therein; and flanking it we found the sphene rock, forming precisely the same succession of beds as

we had observed at Annagary to the north, and Fintown Gap to the south of the granite. The other patch of non-granitic rock is a thin bed of limestone, which is very highly inclined, and runs for a distance of 9 miles, in a direction corresponding to that of the limestone beds outside the granite area, the direction of which is nearly parallel to that of the main axis of the granite. The discovery of these rocks appears to me to show that the granite of Donegal has been produced by some action on the rocks there existing, which was insufficient to destroy all bedding therein, or even to convert the whole mass into granite. This is borne out by the fact that we find oligoclase and quartz in the same rock, an association which would be hardly possible if the rock be supposed to have been in a state of simple fusion.

That the constituent minerals of granite are found in localities into which they were never introduced in a state of fusion, is shown by the specimen from Crohonagh quarry, near Lough Mourne, which is taken from a vein in the mica slate, and contains pink feldspar and quartz. The quartz is precisely similar to that found in ordinary quartz veins.

In consequence of the abundance of oligoclase in the granites of the Continent, and, in general, of basic minerals, such as mica, in all granites, it is to be expected that this idea will have occurred to others; and it is employed by Professor H. Rose in a paper of which an abstract appears in "Phil. Mag." vol. xix. p. 32, as an argument against the purely igneous origin of granite. Among his other arguments, he introduces one from the fact that the density of quartz in granite is not the same as that of the forms of silica found in basalt, a rock which has been undoubtedly fused. An answer to this has been published by M. C. Ste. Claire Deville, "Phil. Mag." vol. xx. p. 175, who compares the crystallization of oligoclase from a menstruum containing free silicic acid, to the crystallization of salts, which are either anhydrous, or contain a less quantity of water of crystallization than their normal amount, from an aqueous solution. At all events, the old idea that granite contains none but trisilicated felspars is totally false, as will be evident to any one who remembers that the definition of granite given by Professor Gustav Rose, in 1849, and quoted at the commencement of this paper, includes oligoclase and quartz as indispensable constituents of the rock. It appears to us that there may be two origins for granite, as some granite appears to be undoubtedly igneous. In the Mourne mountain granite district, at Carlingford, you can observe that the fossils in the neighbourhood of the granite and syenite veins have been calcined. In fact, as has been remarked by Delesse, petrologists have drawn too hasty conclusions as to the mode of formation of minerals, as they have assumed, when they had once succeeded in forming a mineral artificially, that it could have been formed in nature in no other manner.

The time allotted to our tour was so limited, that we could not examine the granite of Barnesmore, which therefore remains for a future examination. I may say that it is traversed by several pitchstone dykes, one of which is converted, by the presence of stilbite, into a pe-

culiar porphyry, described by our President in the "Philosophical Magazine" for 1857.

As the heading of the paper includes the associated minerals, I may in conclusion mention one or two which occur in the district, and are some of them new, at all events to that part of Ireland.

At Crohy Head, near Dunglow, soapstone occurs: the rock is found pretty abundantly through the mica slate district, but it is found in sufficient purity to repay the cost of working for exportation at Crohy. It is quarried in the face of the cliff, and occurs in beds, some of which are upwards of two feet thick. The demand for this article is of recent date, and it is probable that a more diligent search will discover pure deposits of it in other parts of the county. At Aghadoey, near the town of Donegal, we found two very curious lodes in the gneiss; the direction of these coincides with that of the principal system of joints in the granite; one of these is filled with serpentine, containing magnetic iron, the other is garnet rock, accompanied by quartz, the two micas, and a considerable quantity of schörl, the latter, however, considerably decomposed. The clay at the surface of the ground yields, on washing, garnets somewhat resembling pyrope, but of a lighter colour than that mineral. Massive garnet is not uncommon in Ireland, but a rock composed of an aggregation of distinct crystals is very rare, and has not, as far as I know, been described as occurring in these islands.

The extreme northern part of the county has not yet been examined, and we hope to be able to visit it next Easter.

In conclusion, I am desirous of expressing our thanks to Mr. Harte, the county surveyor of the western district of the county, one of our life members. This gentleman placed his knowledge of the country at our disposal during our tour, and himself collected a great number of our most valuable specimens. This he was enabled to do in consequence of his position, and knowledge of the district. I need only say, that without his assistance the tour would have been far less fruitful than it fortunately turned out to be.

APPENDIX.

Since the above was written I have found views which in some respects anticipate the conclusions which I have drawn relative to the possible origin of granite, in a paper by Delesse, which is contained in "*Bulletin de la Société Géologique de France*," 2nd Series, tom. xv. p. 728, from which I shall append some extracts; but must refer the reader to the original paper, in order to see the question discussed *in extenso*. The paper is entitled, "Investigations on the Origin of Rocks," and the learned author discusses three distinct types of eruptive rocks, which are respectively, (a) of undoubted igneous origin; (β) of apparent igneous origin; (γ) of origin which is not igneous.

The rocks of *undoubted igneous origin* are characterized, according to this author, by the following properties:—They rarely, if ever, contain water. They possess, in a remarkable degree, a cellular structure,

and a peculiar roughness to the touch. Their minerals have a glassy lustre, and on the whole they present the appearance of volcanic rocks, being often actually lavas, exhibiting traces of having flowed as such. The extreme members of this group are trachyte and dolerite.

The rocks *whose igneous origin is only apparent*, always contain water. They exhibit at times a cellular structure, but their minerals have only a slight glassy lustre. They are frequently columnar, and accompany volcanic rocks in many localities. The members of the group are pitchstone, basalt, and trap.

For the description of these I must refer to the original paper, but I shall extract the remarks on granite more at length. This rock belongs to the class which are *not of igneous origin*, corresponding to the "plutonic" rocks of Lyell. Its minerals never exhibit a glassy lustre, nor has it a cellular structure. It resembles trachyte in constitution, but it contains a large quantity of quartz, a mineral almost totally absent from the igneous rocks. Trachyte contains as high a percentage of silica as there is in granite, but this substance does not separate from the mass in the form of quartz. This mineral appears in granite both in the crystalline form, and as a glass distributed through the whole rock, and is not traversed by cracks as in many lavas. It need not owe its glassy lustre to fusion, as quartz which has been obtained in the wet way exhibits the same; and further, we find that actual fusion of quartz produces a glass of a totally different character, and one which has not as yet been discovered in rocks. In lavas, we find pieces of quartz which are full of cracks, and have been more or less acted upon by heat; but if that heat had risen high enough to fuse the quartz, chemical action must have taken place between it and the bases which are present in the rock. In addition to this, no glass, however high may be the percentage of silica which it contains, ever yields quartz on cooling, so that the mineral has never as yet been produced by the action of heat. All these points are in direct contradiction to the view that the quartz of granite has been formed by the dry way. The presence of organic liquids, &c., in it points to the same conclusion. In speaking of the production of quartz by the wet way, we do not mean to imply that there was enough water present to hold the mineral in solution, but only that the agency of aqueous vapour co-operated with other forces, such as an elevated temperature and a high pressure, in rendering the rock plastic.

The feldspars which occur in granite are destitute of glassy lustre, and are nearly opaque. They frequently contain water. It is true that adularia does not come under any of these definitions; but it is never found unless in cracks, and appears to have been produced by sublimation, like the artificial feldspar found at Sangershausen. Feldspar can certainly be formed without the interposition of heat sufficient to melt it, as it is found in stratified rocks which have never been fused.

Of the two micas, the dark variety, containing iron and magnesia, is found in all granites, and presents in them an appearance quite distinct from that which it exhibits in the volcanic rocks, occurring in thicker plates, of a darker, colour, and with a more brilliant lustre than it does

in lavas, &c. The white variety of mica is never found in volcanic rocks at all.

Thus we see that the three constituents of granite may be produced without the intervention of a very high temperature.

M. Delesse then alludes to the occurrence of metallic veins in granite, through which rock they are distributed in such a way that the origin of the two must have been simultaneous, and to the fact that some of the minerals found in that rock, such as orthite and gadolinite, glow on the application of heat, proving that the rock never could have reached the temperature of a red heat.

In conclusion, he states his conviction, that granite had been protruded in a plastic condition, under considerable pressure, which had forced it into the veins in which it is often found. Its occurrence in fine thread veins he attributes to a segregation of its component minerals from the sides of the cracks.

The rocks whose origin the author considers to have been analogous to that of granite are diorite and serpentine. As several of the points brought forward by M. Delesse have received a direct confirmation by the facts observed by us during our tour, I have taken the liberty of appending to my paper the foregoing extracts, as I am of opinion that the obvious difficulties involved in the assumption that granite is an igneous rock at all in the same sense that lava is so, are brought forward to the extent that they deserve. There are undoubtedly difficulties to be explained on the other view of its origin, but it is only by a careful investigation of the facts than we can ever arrive at a correct conclusion.

XIII.—On the Primary Rocks of Donegal. By Ethelstone H. Blake, Esq. (Plate III.)

[Read before the Geological Society of Dublin, November 18, 1861.]

Having been for the last six months engaged in a mineral examination of several extensive properties in the north-west portion of the county of Donegal, I have asked the permission of the Council to communicate the result of my observations, which, I trust, may prove of interest to the Society.

I shall commence my observations at Killybegs, taking the Teelin district, with the remarkable cliffs of Slieveleague, which form the S. W. extremity of the primitive range of Donegal; and I shall give you the result of my observations, trusting that you will remember that my only aim is to give you the facts as I found them.

I examined the primitive rocks between Kilcar and Killybegs, and found them to consist of mica-slate and quartzite rocks, highly ferruginous. These bands run in a direction slightly N. of E., magnetic.

At Kilcar, eight miles west, there is a variation in the structure to an E. and W. direction,—the structure being vertical, and the rocks becoming highly mineralized. They produce, at all the springs, strong

streams of ferruginous matter, which form on the surface large beds or layers of peroxide of iron, in some places four or five feet deep, with but a slight covering of about three inches of sod. The district in which these deposits are found, is composed chiefly of mica-slate, containing large quantities of iron pyrites, in a state of decomposition. The original structure of these rocks has been completely changed in the localities which afford the principal deposits. These are found in the faces of the rocks where the planes of structure serve as mineral conductors,—the original vertical structure of the slate having been changed to a semi-horizontal one, and the rocks themselves highly contorted.

This band of rock extends from Kilcar, eight miles W. to Malinmore, and forms the cliffs of Slieveleague, 1900 feet high, with the structure vertical, running about N. N. E., magnetic. In the centre of this band is one of quartz, which is broken through, N. of Carrick village, and then takes a direction nearly E. and W., but with the structure remaining vertical. North of this is a band of mica-slate, with a very flat underlay at surface, intersected by four porphyritic dykes. About a quarter of a mile further north is another band of mica-slate, with a northern underlay at surface. These are all bounded on the western side by bands of primitive limestone and mica-slate, running N. N. E., with the structure vertical, forming the cliffs of Glenhead, 800 feet perpendicular. These bands of rocks run to the town of Ardara, forming the range of mountains of Loughrosmore, and forming the S. E. flank of the granite range which here makes its appearance. West of this, on the point of Loughrosbeg, in the immediate vicinity of the granite, the structure of the slate is semi-horizontal, dipping to the S. W.

Soon after passing Ardara, on this band, I find the band to consist of alternate crystalline limestone, mica-slate, and quartzite rocks, which maintain a perfectly vertical structure for some 38 miles in length (with only one or two slight exceptions, which I shall again refer to), and having a bearing from 10° to 15° N. of E., magnetic. The whole range from this to Barnesmore granite range consists of alternate bands of micaceous and hornblendic slate, quartz, and crystalline limestone,—the highly elevated mountains showing occasionally a deviation from the vertical structure, but only in isolated places.

I examined this range as far east as Stranorlar, and south from thence to Lough Eask. By reference to the sections I have made from maps taken on the spot (Plate III.), you will see the perfect regularity of the bands of rock. This is a convincing proof, to my mind, that the granite ranges, which are here only visible for a short distance, have had nothing to do with the elevation of these mountains, as in that case the regularity existing on both flanks of the two ranges could not continue, supposing the upheaved beds to have been originally horizontal, and upheaved by them in the centre.

I allude to this here, as it will have a material bearing upon the question of the granite range forming the Doocharry and Dunglow district.

I shall now return to the granite, which makes its appearance a quarter of a mile to the N. of Ardara, and takes a direction 10° to 15° N. of E., having on both flanks bands of crystalline limestone and mica-slate, with perfectly vertical structure. At Narin, four miles to the N. W., at the turn of the road to Maas Bridge, the constitution of the rock is such, that it is very difficult to say where the slate ends and the granite commences.

In this slate range, which takes a course slightly N. of E., you will find several bands of white limestone, differing from each other, so as to be easily identified again, and which I have traced from this point to Gartan Lough, twenty-eight miles, maintaining an unvaried vertical position, and, as the sections will show, with no perceptible difference in the width of the different bands. These bands form the range to the north of Fintown Lough, where the rocks consist of alternate bands of limestone, gneiss, mica-slate, quartz, and hornblende rock, maintaining a perfect regularity, and hardly showing where the one ends and the other commences. The western extremity of this band forms the Maas and Lettermacaward district, extending from Narin to Russell's Ferry, where we again meet the granite range, extending thence in a W. direction as far as Dunglow, about eight miles. This range is intersected by several bands of limestone at a little west of Russell's Ferry, running 10° to 15° N. of E., magnetic, which are traced again at Glenleheen, and beyond that again N. W. of Glendowan. One of these bands runs through the Croagheghly mountain, and is traced again at Tobberkeen, near Maghery. Another makes its appearance at Maghery, accompanied by a band of hornblende and syenite, corresponding to that seen again N. E. of Loughanure, and to which I shall have further occasion to refer.

These bands of limestone, especially the two found at Glenleheen, from their immediate connexion with the granite, present some peculiarities which are worthy of observation. I shall therefore, before proceeding further, give a short description of the bands seen at Glenleheen.

On leaving the junction of the granite and slate range at Fintown, going west, on Section No. 1, at the centre, you pass for about a mile through a gorge in the granite range, in which are to be seen several veins of quartz and felspar. Near the foot of the hill is a band of white limestone on a bye-road, on the Marquis of Conyngham's property, which runs through the granite for miles, as far as Glendowan, and has been referred to before at Narin. Half a mile further on we come to the summit level of the road to Doochary Bridge; and here we have an outcrop of two bands of limestone and mica-slate, with a vertical structure, running the same as the granite in the whole of this district, 10° N. of E. These bands have the granite on both sides for a distance of a mile to the east, and of ten miles to the west. The cause of their position here, supposing them to have been originally in a horizontal position, and to have formed a part of the rocks on the flank of the granite range, I leave for your consideration, merely adding that the limestone con-

tains garnets and chalcedony. The mineralogical constitution of the rocks has already been brought before you, in the paper which has just been read by Mr. Scott.

I must now, ere I proceed further, call your attention to the Maghery or Crohy Head district, where I find the greater part of the rocks to be mica-slate, containing also bands of talcose slate and steatite, or soap-stone, which are now being developed for commercial purposes, having been brought to notice by the Mineral Exploring Company. An establishment for dressing the material on the spot is about to be erected, under the management of some English capitalists. The use made of the stone is as a lubricating material for machinery. There is only a fringe of quartz on the sea-coast here for a short distance, the inland portion of the headland being mica-slate, as far as Trawena bay.

This district I have not been able to examine as thoroughly as I could wish, as the objects of my survey were for commercial purposes, and I could not afford the time required to examine more than the leading features. West of Dunglow the granite continues for four miles, extending into Arranmore Island, where we meet the primitive quartz on its west flank, with a vertical structure running E. of N.

I must now pass to a more northerly section from Annagarry, through Gweedore and Dunlewy, to Letterkenny (section No. 2). Here some remarkable features present themselves. At Annagarry we find the limestone again making its appearance, and also at Loughanure, with garnets and idocrase, similar to those found near Maghery and Tobberkeen. Here we also find syenite making its appearance in bands through the granite. To this I must call your particular attention, as the syenite continues from this to Horn-head, forming two separate branches at Dunlewy, enclosing between them a range of quartz, mica-slate, and limestone, which forms the mountains of Arrigle, Meenacappagh, and Muckish, and maintaining a perfectly regular vertical structure throughout the entire length, until lost in the sea.

After passing the Gweedore river, we come upon the quartz range running to the N. E., and having the granite on its W. flank, with a band of limestone at Bunbeg, containing the garnets and idocrase. These are not visible in the limestone found at Dunlewy, except the garnets, in a quartz rock, which I have found at Creeslough, on the E. flank of the syenite range.

After passing Gweedore hotel, we come to a band of slate running N. E., and in which, at its junction with the quartz, is situtated the lead mine of Keeldrum, now worked by the Mining Company of Ireland. Here the structure of the slate dips to the S. E., but becomes more vertical as you descend in the mine. Through this slate band there are two or three bands of limestone, before you come to the syenite, which runs on the N. W. flank of Arrigle mountain, and from thence in a regular course to Horn-head, becoming, at its northern extremity, a series of bands of hornblende, porphyry, and syenite. The change in the formation is so gradual, that at a section at a place called the Rock, west of Dunfanaghy, it is quite impossible to distinguish between them.

I would call the attention of all geologists passing that way to this remarkable rock by the road-side.

I must now proceed to the eastern flank of Arrigle, where we find another branch of the syenite trunk, accompanied by hornblende-slate, mica-slate, and several bands of white and blue limestone, which run from hence with a perfectly vertical structure, as far as Glen and Sheephaven. Their junction with the west flank of the granite range presents the same uninterrupted course that those on the eastern side present at their southern extremity at Fintown.

We now cross the granite range, and come to the corresponding eastern flank of the granite; but here we find the composition of the rocks widely varying from that on the western side,—the slate having become highly siliceous in its character in some places, and in others presenting the appearance of a regular porphyry, but without any alteration in its structure or bearing, and without any upheaval, faults, or other visible cause for such alteration.

The porphyritic character commences east of Gartan Lough, after passing the limestone band running from Fintown, and continues through the valley of Kilmacrenan, where the slate abounds in carbonate of lime. At Little Barnesmore Gap, the granite is bounded by a band of quartz on its east flank (section 3), whilst on the opposite flank there is a band of limestone in immediate contact with the granite. From this to Creeslough, in an easterly direction, we have alternate bands of hornblende-slate, syenite, mica-slate, and limestone, with the most perfectly regular structure, which continues till we meet the quartz range at Ards. Then comes the syenite range, and again limestone, slate, quartz, and syenite, to Horn-head and Dunfanaghy. Here we have large masses of rocks corresponding with those at Creeslough, lying in a horizontal position, in detached masses over the syenite. At the same time we find bands of crystalline limestone, with vertical structure, the same as the syenite, and bands of porphyry running with them under these detached masses, which cover an area of about a mile and a half in extent, and incline in a N. W. direction, as if fallen over from the east side, and commence on the north side of a fault above the lake of Sessiagh, on the S. E. side of Dunfanaghy.

I carefully examined all the bands of rocks through Muckish Gap from the cross-roads, and also from Creeslough across to Muckish, in all directions, and find the greatest regularity, no appearance of any irruptive action, save an upheaval of the whole mass at some period. The mountain of Muckish itself presents a very curious and interesting feature. It consists of primitive quartz rock, with planes of lamination or structure, varying from one foot to a few inches in width. At the foot and sides it presents a vertical structure; but at about 1500 feet inclines in an arch to the N. W., as if fallen over from its own weight: the section being diagonal and perpendicular, the lines are to be seen perfectly unbroken, and presenting a most unusual appearance. The summit of the mountain is a plane surface, of some ten or twelve acres in extent. On the summit are three large mounds of stones, one of which

must contain some hundreds of tons, collected at some period, and affording an interesting subject for the antiquarian.

West of Dunfanaghy, we meet the slate range running out from Keeldrum, and before referred to, ending in hornblende and porphyry.

Having now described the greater part of the district, I shall mention a few of the observations that have occurred to me in connexion with it. In the relations between these rocks and those in the east part of the country, my object having been to ascertain its capabilities as a mining district, my attention was particularly called to the discovery of any of those disturbances which by many are supposed to be caused by the irruptive action of granites, trap, &c., forming lodes, cross-courses, faults, &c., and which, in a country consisting of mountains similar to those in Donegal, would be supposed to be a natural consequence. Contrary to this, I have found a district abounding in granites, slate, &c., but presenting scarcely a trace of lodes, and wanting in those very conditions which are supposed to be the result of irruptive action, and presenting to all appearance a regularity quite inconsistent with this idea.

I find, by my friend Mr. Scott's paper, that he and some others are inclined to suppose that the granites of this district are not of igneous origin, and I agree with them. But it will then become a question how these rocks have been formed.

As these questions are of serious consequence to those practically engaged in mining operations, it will not do for us to rest our judgments on theories which do not bear the test of practice; and I believe I may confidently apply to any practical miner to confirm me in the assertion, that the theory of the horizontal deposition of the primitive rocks is opposed to all that we meet with in practice. I can confidently challenge any one to point me out, through the whole district we have this evening gone over, any evidence to confirm it. If we take the district east, from Fintown to Stranorlar, we shall find the same evidence of the vertical structure of the slate, which becomes more siliceous after passing Stranorlar, and we have the whole range south of this till we go to Ballyshannon, or Pettigo district, where we have gneiss and quartzite rock with vertical structure, up to their junction with the sedimentary beds. If we attempt to reconcile this with the theory of an anticlinal axis at the Doocharry district, we shall have no less than three separate axes to account for, and also to account for the quartz bands interlaminated with the syenite to the north of Arrigle, and the limestone bands at Glenleheen. Also, by consulting the map, it will be found that when the quartz range rises to its greatest elevation, that the granite is at its lowest; and in the S. E. portion, north of Barnesmore Gap, the quartz mountains of Gaugin and Altnapaste rise vertically in the centre of the mica-slate; and N. E. of the granite range, where we should expect to find the slate upheaved from a horizontal position, with the two beds inclining towards one another, there is no such appearance; and if we take the S. W. point at Glencolumbkille, we have a perfectly vertical structure of quartz, mica-slate, and limestone, with no visible anticlinal

axis to have produced any such result, although Slieveleague rises to a height of 1900 feet. We have the same in the quartz rock in the island of Arranmore, at Gweedore, Arrigle, and Muckish, and, as far as this district is concerned, throughout its entire extent.

I have now called your attention to the points that I have thought of most interest, as the mineralogical structure of the county will shortly be submitted to examination by the President and Mr. Scott. If I have thrown any light on the question, my purpose will be answered, and I am sure that a further examination of the district will lead to discoveries that will throw additional light on the much-vexed question of the origin of granite. I am sorry that I have been pressed for time, and therefore unable to complete, as I had intended, sections on a larger scale. I hope that on some future occasion I shall be able to do so, as it is only by a careful comparison of several transverse sections of the primitive rocks that we can obtain accurate results as to the question of their upheaval. The rocks of Donegal present unusual facilities for this purpose, from the fact of there being generally an absence of covering, which enables us to see the rocks in their original condition.

I hope at some future period to be able to present you with a section from east to west, showing the structure of the whole of the rocks of the primitive series, through the counties of Armagh, Monaghan, and Louth, when we shall be able to discuss the question more fully on its merits, as by taking isolated cases of small area you may reconcile difficulties which would show themselves on a large scale. The question of an anticlinal axis for all the slate range of Donegal cannot be allowed to depend upon the granite range at its western extremity of only a few miles in width, and divided in such a manner as it is by other rocks.

XIV.—On the Occurrence of some characteristic Graptolites and other Fossils, indicating certain divisions of the Lower Silurian Rocks in the Counties of Meath, Tipperary, and Clare. By William Hellier Baily, F. G. S. (Plate IV.)

[Read Wednesday Evening, January 8, 1861.]

Having in the course of my duties connected with the Geological Survey lately met with a small collection of fossils from Bellewstown Hill, in the county of Meath, amongst which I observed several specimens of the double Graptolite, *Didymograpsus Murchisonii*, so remarkably characteristic of the black Llandeilo flags of North Wales, I considered it important by the evidence they afforded to be enabled to establish the existence in this country of the equivalents of beds, which belong to almost the lowest member of the Silurian series;* and, therefore, in August last, I took a day of my vacation to visit this interesting locality, which is situated about one mile south of Duleek, in a

* The occurrence of these fossils in Ireland was for the first time made known by me in a paper, entitled "Palæontological Remarks on the Silurian Rocks of Ireland," read at the last meeting of the British Association, in Manchester, September, 1861.

field a short distance from the road to Garristown and that leading to the Bellewstown race-course, where I observed a mass of rock, at an elevation of five or six feet, consisting of beds of dark, highly inclined slates, some of which had become metamorphosed into hard black cherty bands, having an angular fracture; a condition precisely similar to what I observed at the commons of Slane, and the cross-roads of Collon,* in the same county, and most probably due to the same cause, namely, the protrusion of an igneous rock in close proximity. A few yards from this elevation of rock, I found a recent excavation at very little depth below the surface, exposing unaltered beds of black slates in a nearly vertical position, which also bore a considerable resemblance to those at the commons of Slane, and the cross-roads of Collon, before alluded to, as well as to those of Belvoir, in the county of Clare, the highly interesting locality I shall presently have to notice. At all these localities the slates, like that under consideration, contained an abundance of another kind of Graptolite, commonly known and figured as *Diplograpsus pristis.* These slates separated readily in the planes of bedding; and besides the characteristic Graptolite, *D. pristis,* and what is said to be a variety of the same species, *D. scalariformis,* I obtained well-marked examples of the following Brachiopods, viz., *Orthis calligramma* and *O. alata,* the latter being a distended species peculiar to the Llandeilo flags, as well as a small species of Discina. The collection of fossils previously made by the Geological Survey from this locality did not include any from these black slates, the rock in which the double Graptolite, *Didymograpsus Murchisonii,* occurred being of a different lithological character; accompanying that species were two single forms, *Graptolithus Sedgwickii* and *G. Nilssoni*; the other associated fossils were all Brachiopods of a very interesting character, consisting of a large and broad Lingula, which I believe to be a new species, allied to *L. Davisii,* a smaller oval species, probably a variety of *L. attenuata,* and several very small and peculiar shells belonging to the same class, some of which may, I think, be referred to *Siphonotreta micula.*

I regret having had so little time at my disposal to search this interesting locality more fully, as I did not succeed in tracing out the bed from which the Survey collection was obtained; I had previously, however, on my way to this place, examined other fossil localities on the same hill; and at one of these, a small cutting in gray slates on the branch road to Duleek, I succeeded in collecting *Didymograpsus Murchisonii,* although the specimens were small and fragmentary. With it I also found *Diplograpsus pristis* and var. *scalariformis,* together with *Lingula attenuata,* and some other small Brachiopods.

The specimens of *Didymograpsus Murchisonii* in the collection of the Geological Survey, from Bellewstown Hill, occur in a dark greenish argillaceous slate, with ferruginous and metallic stains, most probably

* Erroneously called the "Cross-roads of Glenallen," in a paper read by me before this Society, January 12, 1859.

caused by the presence of the oxides of iron and manganese. The lithological character of this deposit differs remarkably from that of the black slates before mentioned as occurring in its immediate vicinity, which, like those of Belvoir, in the county Clare, hereafter noticed, closely resemble the Graptolite slates of the south of Scotland. This well-marked species, *D. Murchisonii*, is distributed through the beds, at right angles to the cleavage, occurring of various sizes and conditions, the smaller examples being remarkably like those from the Welsh slates. In the larger specimens, however, the branches are generally less curved, and more divergent. Pl. IV., Fig. 1*a*, represents the usual form of the Irish specimens, of which 1*b* is a portion enlarged; there are, however, variations in the amount of divergence, some of which may be caused by lateral pressure, as shown in Fig. 1*c*. The cell denticles, which are very clearly defined, appear to be more attenuated than those of the Welsh specimens, and consequently to terminate in a sharper point turned downwards; the filamentary axis connecting the branches is somewhat longer. These apparent differences may, however, arise from its better state of preservation, and the condition of the deposit in which it occurs.

Nearer the Bellewstown race-course, in a plantation a short distance from the main road to Duleek, is an old and somewhat extensive quarry in the Lower Silurians, consisting of beds of gray and brown, more or less sandy shales, very ferruginous when weathered, and dipping W. about 20°. During the short time of my visit I collected fossils from some of these beds, consisting of Trilobite fragments, probably belonging to Acidaspis and Asaphus, small univalve shells of the genera Cyclonema, Raphistoma, and Ecculiomphalus, several species of Brachiopods, amongst them being *Leptæna sericea* and *Strophomena depressa*, as well as a species of Theca, and the branching variety of the small coral, *Stenopora fibrosa*, so abundant throughout the Silurian series. From the general character of the fossils, I should consider these beds to be of Caradoc or Bala age, and therefore to overlie the Graptolite slates before mentioned; they bear considerable resemblance to deposits believed to be of the same age in the county of Waterford, and would, doubtless, if well searched, yield, like them, many interesting organic remains.

The fossil locality I have next to notice, which I believe to be the equivalent of the Llandeilo flags, was discovered by Mr. G. H. Kinahan, of the Geological Survey, on the western flank of the Slieve Bernagh mountains, in the county of Clare, and is remarkable for the abundance of Graptolites, of several species, and the interesting Pteropod shells accompanying them; the black slates in which they occur being exposed in a stream, forming the boundary of the townlands of Belvoir and Crag; the beds are highly inclined, and readily separate into layers. The prevailing form is the double Graptolite, *Diplograpsus pristis*, and its variety *D. scalariformis;* this characteristic species is distributed over the surface of the various layers in great profusion; and although much compressed, as usually the case with fossils enclosed in slates of this character, they are remark-

ably well defined. Examples were collected of various sizes and conditions, some of them showing at both extremities a fine thread-like axis continued beyond the serrated outline of the cells; at the upper extremity this portion of the axis, devoid of cells, is of greater diameter and length than at the lower, being in one specimen, Fig. 2*a*, more than an inch long, whilst at the opposite end it is a mere filament, seldom extending beyond $\frac{2}{10}$ths of an inch; this peculiarity has been represented by Mr. James Hall, in the Palæontology of New York,* whose figures of *D. pristis* from the Utica slate and Olive slate of the Hudson's Bay group, appear to be identical with our specimens. Dr. H. B. Geinitz, however, in his fine work on Graptolites† refers Hall's figures to *D. dentatus*. General Portlock, in his Geological Report on Londonderry, &c.‡, gives several figures of double Graptolites, some of which he refers to *D. pristis*, others to *D. foliaceus*, Murchison: one of these, Fig. 10, shows the axis extended for some distance beyond the serratures at one extremity, as in the Belvoir specimens; Figs. 9 and 11 on the same plate also resemble specimens from that locality—they are, however, referred by Dr. Geinitz to *D. foliaceus*. Under the same name Professor Harkness also figures Graptolites from the Dumfriesshire slates, an identification which is confirmed by Dr. Geinitz. These Scotch examples appear to me to be undistinguishable from our Belvoir specimens, and they are, I think, correctly referred by Professor Morris, in his catalogue of British fossils, to *D. pristis*. From these instances it will be seen that much confusion has arisen with regard to the identification of fossils with this species by various authors, arising from the great similarity of character between the species, some of which will possibly prove to be synonyms, when the group of Graptolites is more fully worked out. The most universally distributed Graptolite throughout the slate rocks of Llandeilo age in the United Kingdom is certainly *Diplograpsus* (Prionotus) *pristis*, Hisinger. Under these circumstances, therefore, I have thought it advisable to refer the specimens under consideration to that species. Those showing prolonged axis beyond the cell denticles (represented on Plate IV., Figs. 2*a*, *b*, *c*), are mostly of the variety figured by Hisinger as *Prionotus scalaris*—*D. scalariformis*, Geinitz, a variety considered by M. Barrande to be merely a modification arising from lateral pressure. On the slabs from Belvoir they are, however, generally found grouped together, and seldom accompanied by the serrated form of *D. pristis*, Fig. 3*a*, *b*. All bear the same character of a non-serrated outline, with alternate horizontal cell divisions on each side of a central axis, the portion of the axis continued beyond the cells being much longer and of stouter proportions, in some specimens swelling out and channelled, as in Fig. 2*b*. In the distinctly serrated forms very few have the axis continued beyond the serratures; and where observable, it is generally shorter, and of a much finer character. From the study of these specimens, I am, therefore,

* Nat. Hist., New York, part vi.; Palæont., vol. i., pl. 72, fig. 1.

† Die Graptolithen, &c. Leipzig, 1852.

‡ Geological Report on Londonderry, Tyrone, and Fermanagh, pl. 19.

inclined to doubt whether it should not still be retained as a distinct species.

Some of the serrated Grapolites exhibit remarkable long filaments proceeding from the cells, similar to *D. dentatus*, Brongniart, as figured by Dr. Geinitz,* but still more like *D.* (*Graptolithus*) *mucronatus*, Hall,† a species to which I have referred them, and which is considered by Dr. Geinitz to bear the character of *dentatus*. These are shown at Figs. 4*a*, *b*, *c*. Fig. 4*a* represents the largest example of this peculiar species; it has a very short and fine axis, continued beyond the filamentary cells. Fig. 4*b* is taken from a specimen which is bent and twisted in a singular manner, showing the remarkably long filaments proceeding from the cells. Fig. 4*c* is from a short and probably a young individual, somewhat approaching in form *D. folium*, Hisinger, and having an axis nearly as long as the part covered by the cells. Possibly these forms may prove merely varieties of *D. pristis*.

A peculiar and very distinct form of Graptolite (Fig. 5*a*, *b*, *c*), abundant in these slates, resembles so much the figures of *Graptolithus gracilis*, Hall,‡ that I have without hesitation referred it to that species. It appears to have been spirally curved, branches being given off from the main axis at regular intervals, some of which show distinctly the cell denticles, a portion of which is enlarged at 5*b*. In some of the specimens (as in Fig. 5*c*) there is an extraordinary lengthening of the branches, which are bent and twisted about in all directions. This remarkably graceful and elegant form of Graptolite is somewhat allied to *Rastrites peregrinus*, differing from it, however, in the greater length of its branches and in their being provided with numerous cell denticles. Being doubtful as to the genus in which to include this remarkable form, I retain it provisionally under the general generic term given it by Mr. Hall; Dr. Geinitz does not, however, consider it to belong to the group of Graptolites, but rather to that of the Sertularidæ.§

The only other Graptolites collected at this locality which I have been enabled to determine are the single forms, *Graptolithus Nilssoni* and *G. priodon;* the latter species, which is most abundantly distributed throughout the lower Silurian rocks of this and the neighbouring county of Tipperary, occurring at more than fifty localities examined by the Geological Survey, is here very scarce, two or three examples only having been met with.

Some interesting little fossils accompanying the Graptolites in these slates (to which Mr. J. B. Jukes first called my attention), I beielve to be Pteropods, and to belong to the genus *Theca* (*Pugiunculus*, Barrande); the impressions of these delicate little shells are scattered over the surface of the slates in various positions, sometimes occurring in great profusion in groups of larger and smaller sized individuals; I have named

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* Die Graptolithen, &c., pl. 1, fig. 26.

† Nat. Hist., New York, part iv., Palæontology, vol i., pl. 73, fig. 1.

‡ Nat. Hist. of New York, part vi., vol. i., pl. 74, fig. 6.

§ Die Graptolithen, &c., p. 19.

them *Theca cometoides*, from the resemblance they bear to the appearance of a comet in motion. Pl. IV., Fig. 8*a*, represents a group of the natural size. These very thin, conical, and flexible shells are of various sizes, from the tenth of an inch to half an inch in length, the largest having a diameter of about the eighth of an inch. Commencing from a distinct point, they gradually widen out, the impression becoming fainter and less distinct towards its widest extremity, which is without any definite outline. The point is in some cases bent, and the shell slightly curved, showing its extremely thin and membranous character. Fig. 8*b* is an enlarged view of one of these, on which are faint indications of annular markings like septæ.

The Silurian rocks of parts of the counties of Tipperary and Clare, where examined by the Geological Survey, have yielded a large amount of fossils of a very interesting character, amongst which are several new species, and others new to Britain, which are described in the Palæontological notes to the explanation of Sheet 133, &c., of the maps of that district, just published.

Amongst the Graptolites, some remarkably fine specimens of the common single form, *Graptolithus priodon*, were obtained by the fossil collector, Mr. Charles Galvan: one of these, although incomplete, measuring fourteen inches in length; others, procured from nodules and grit beds, are in an uncompressed form, showing the structure remarkably well. A small branching species from near Borrisoleigh, in the county of Tipperary, I believe to be undescribed, and have named it *Graptolithus hamatus*,* from the hooked character of a portion of its cells. Fig. 6*a* shows the natural size, and Fig. 6*b* the same enlarged.

This little Graptolite, which is gracefully curved, after proceeding single for about half its length, becomes divergent,—the lower portion of the axis is furnished with prominent cells, very much recurved; those on the branches being more distant, and much less prominent.

The collection also includes another diverging Graptolite, *Didymograpsus* (*Cladograpsus*) *Forchhammeri* (Geinitz),† from Kilnacreagh, in the county of Clare (Fig. 7*a*, *b*), a species which has not hitherto been recorded as occurring in the United Kingdom. In this species the branches are long and straight, diverging from a central point, at an angle of between 30° and 40°, and provided with numerous closely-arranged and somewhat rounded cell denticles, a portion of which is shown enlarged, Fig. 7*b*.

The importance of Graptolites in determining strata of Silurian age is well known to geologists, they having never yet been found in any rocks of more recent formation. All the double forms are confined to the lower Silurian division, being most abundant in the lowest series of beds,

* I had referred this new form of branching Graptolite to the genus *Didymograpsus* (see explanation to Sheet 133, before quoted), but in deference to Mr. J. W. Salter's opinion, I have now included it under that of Graptolithus.

† Die Graptolithen, &c., pl. 5, fig. 28-31.

equivalents of the Llandeilo flags; one species only of this remarkably characteristic group, the *Graptolithus priodon*, a single form, ranging through the series from lower to upper Silurian.

ANNUAL GENERAL MEETING, WEDNESDAY, FEBRUARY 12, 1862.

The Rev. Samuel Haughton, President, in the Chair.

The following Report from Council was submitted and adopted:—

REPORT.

The Council have the satisfaction of reporting to the Society, that it continues to maintain the prosperity and activity which have characterized it during preceding years.

Some loss has been sustained by the decease of Members, among whom the Council regret to mention the name of Mr. M^c Adam, of Belfast, one of the original Members of the Society, and well known to all British Geologists for his knowledge of the structure of Antrim and its borders, and his collection of the fossils of that district.

Notwithstanding this loss, and that of four other Members by death, and eight by other causes, the number of our Members has been increased by two during the past year.

The Treasurer's balance sheet will show that our finances are in a satisfactory state,—inasmuch as there was a balance of £28 4*s*. 0*d*. to our credit on the 31st of December. The remainder of Mr. Gill's account for printing our journal, viz. £26 5*s*. 3*d*. has since been paid, thus discharging all the liabilities due on the double number of our Journal, which has been distributed to our Members during the past year.

The property of the Society now consists of a sum of £100 in the Government funds, and the Books, Maps, and Furniture in the Council-room, which have been valued at £200. There is, then, a total value of £300, to represent the Life Compositions of the Members. The Compositions of the existing Life Members would amount to a sum of £465.

In the Appendix will be found:—

1st. A list of all the Members now on the books of the Society.

2nd. A list of the Members gained and lost during the year.

3rd. A list of the Donations received during the last year.

4th. A list of the Societies and Institutions to whom a copy of our Journal is regularly forwarded.

5th. An abstract of the Treasurer's accounts for the year 1861.

APPENDIX TO ANNUAL REPORT.

No. I.

LIST OF MEMBERS, CORRECTED TO JANUARY 31, 1862.

Members are requested to correct errors in this List, by letter to the REV. SAMUEL HAUGHTON, *Trinity College, Dublin.*

HONORARY MEMBERS.

Elected.
1844. 1. Boué, Ami, For. Mem., L. G. S., *Paris.*
1861. 2. Daubree, M., Membre de l'Institute, 91, *Rue de Greville, St. Germains, Paris.*
1861. 3. Delesse, M., Ingenieur des Mines, *Paris.*
1861. 4. De Serres, M. Marcel, *Montpelier.*
1861. 5. Deville, M. Charles, *Paris.*
1861. 6. Deville, M. Ste Claire, *Paris.*
1861. 7. De Koninck, M. L., *Liege.*
1861. 8. Geinitz, M. H. B., *Dresden.*
1844. 9. Lyell, Sir Charles, F. R. S., 53, *Harley-street, W., London.*
1861. 10. M'Clintock, Sir Leopold, R. N.
1844. 11. Murchison, Sir Roderick I., F. R. S., 16, *Belgrave-square, London.*
1832. 12. Sedgwick, Rev. A., F. R. S., *Cambridge.*

HONORARY CORRESPONDING MEMBERS.

1854. 1. Thomas Oldham, F. R. S., *India.*
1854. 2. Arthur A. Jacob, C. E., *India.*
1855. 3. Joseph Medlicott, *India.*
1859. 4. John Gordon, C. E., *India.*
1859. 5. Henry J. B. Hargrave, C. E., *India.*
1859. 6. John Hime, C. E., *Pernambuco.*

MEMBERS WHO HAVE PAID LIFE COMPOSITION.

1853. 1. Allen, Richard Purdy, 10, *Besboro'-terrace, N. C. Road.*
1861. 2. Armstrong, Andrew, *Claddagh, Bray.*
1861. 3. Brown, Markham, *Connoree Mines, Ovoca.*
1857. 4. Carson, Rev. Joseph, D. D., F. T. C. D., *Trinity College.*
1861. 5. Connolly, J., *Kilmore, Artane.*
1832. 6. Davis, Charles, M. D., 33, *York-street.*
1857. 7. Dowse, Richard, *Mountjoy-square.*
1861. 8. Fottrell, Edward, 86, *Harcourt-street.*
1857. 9. Greene, John Ball, 6, *Ely-place.*
1857. 10. Haliday, A. H., A. M., F. L. S., M. R. I. A., *Harcourt-street.*
1831. 11. Hamilton, Sir W. R., M. R. I. A., *Observatory, Dunsink.*
1848. 12. Haughton, Rev. Professor, F. R. S., 40, *Trinity College.*
1850. 13. Hone, Nathaniel, M. R. I. A., *St. Doulough's, Co. Dublin.*
1861. 14. Hone, Thomas, *Yapton, Monkstown.*
1831. 15. Hutton, Robert, F. G. S., *Putney Park, London.*
1851. 16. Jukes, Joseph Beete, F. R. S., 51, *Stephen's-green.*
1834. 17. King, Hon. James, M. R. I. A., *Mitchelstown.*
1856. 18. Lentaigne, John, M. D., *Great Denmark-street*
1848. 19. Luby, Rev. Thomas, D. D., F. T. C. D., *Trinity College.*
1851. 20. Malahide, Lord Talbot de, F. R. S., *Malahide Court, Malahide.*

Elected.
1838. 21. Mallet, Robert, C. E., F. R. S., 1, *The Grove, Clapham-road, London.*
1846. 22. Murray, B. B., 6, *Martello-avenue, Kingstown.*
1859. 23. Ogilby, William, F. R. S., *Liscleen, Dunmanagh, Co. Tyrone.*
1849. 24. Sidney, F. J., LL. D., 10, *Herbert-street.*
1851. 25. Whitty, John Irvine, LL. D., *Henrietta-street.*

MEMBERS WHO HAVE PAID HALF LIFE COMPOSITION.

1831. 1. Baillie, Rev. James Kennedy, D. D., *Ardtrea, Stewartstown.*
1854. 2. Barnes, Edward, *Ballymurtagh, Co. Wicklow.*
1832. 3. Bryce, James, *High School, Glasgow.*
1861. 4. Busteed, Dr., *Castle Gregory, Tralee.*
1855. 5. Clarke, Edward, M. D., 3, *Frankfort Buildings, Rathgar.*
1854. 6. Clemes, John, *Luganure Mine, Glendalough, Co. Wicklow.*
1857. 7. Crawford, Robert, C. E., *care of Messrs. Peto and Betts*, 9, *Great George's-street, Westminster.*
1861. 8. Crosbie, George, *Ardfert Abbey, Ardfert, Tralee.*
1861. 9. Dunally, Lord, *Kilboy, Nenagh.*
1856. 10. Du Noyer, G. V., M. R. I. A., *Dunloe, Frankfort-avenue, Rathgar.*
1832. 11. Dunraven, Earl of, F. R. S., *Adare, Co. Limerick.*
1836. 12. Enniskillen, Earl of, F. R. S., M. R. I. A., *Florence Court, Enniskillen.*
1844. 13. Esmonde, Sir Thomas, Bart., M. R. I. A., *Johnstown Castle, Wexford.*
1854. 14. Foot, Frederick J., 51, *Stephen's-green.*
1853. 15. Harkness, Professor, F. G. S., *Queen's College, Cork.*
1856. 16. Haughton, Lieut. John, R. A., *St. Helena.*
1857. 17. Haughton John Hancock, Esq., *Carlow.*
1861. 18. Harte, W., C. E., *Donegal.*
1850. 19. Head, Henry, M. D., *Lower Fitzwilliam-street.*
1858. 20. Hill, J., C. E., *Tullamore.*
1840. 21. Jackson, James E., *Tulliderry, Blackwatertown.*
1839. 22. James, Sir H., Colonel, R.E., F.R.S., *Ordnance Survey Office, Southampton.*
1832. 23. Kearney, Thomas, *Pallasgreen, Co. Limerick.*
1857. 24. Keane, Marcus, *Beech Park, Ennis, Co. Clare.*
1835. 25. Kelly, John, 38, *Mountpleasant-square.*
1853. 26. Kinahan, George H., *St. Kilda, Sandycove, Dalkey.*
1839. 27. Lansdowne, Marquis of, 54, *Berkeley-square, London.*
1838. 28. Larcom, Sir Thomas, R E., LL. D., F. R. S., *Phœnix Park.*
1858. 29. Leech, Lieut.-Colonel, R. E., *Mountjoy Barracks, Phœnix Park.*
1840. 30. Lindsay, Henry L., C. E.
1840. 31. Montgomery, James E., M. R. I. A.
1856. 32. Molony, C. P., Capt., 25th Regt., Madras N. I., *per Messrs. Grinlay and Co.*, 3, *Cornhill, London.*
1856. 33. Medlicott, Henry, *Roarkee, Bombay.*
1857. 34. M'Ivor, Rev. James, *Rectory, Moyle, Newtownstewart, Co. Tyrone.*
1845. 35. Neville, John, C. E., M. R. I, A., *Dundalk.*
1852. 36. O'Kelly, Joseph, 51, *Stephen's-green.*
1844. 37. Palmerston, Viscount, G. C. B., M. P., 4, *Carlton Gardens, London.*
1832. 38. Portlock, Major-Gen., R. E., F. R. S., 58, *Queen's Gardens, Hyde Park.*
1832. 39. Renny, Henry L., R. E., *Canada.*
1854. 40. Smyth, W. W., F. R. S., *Jermyn-street, London.*
1832. 41. Tighe, Right Hon. William, *Woodstock, Innistiogue.*
1834. 42. Verschoyle, Archdeacon, *Rathbarron, Collooney.*
1853. 43. Webster, William B., 104, *Grafton-street.*
1861. 44. Whitney, C. J., *Bloomfield House, Circular-road, S.*
1846. 45. Willson, Walter, 51, *Stephen's-green.*
1854. 46. Wyley, Andrew, 51, *Stephen's-green.*
1857. 47. Wynne, Arthur B., F. G. S., 51, *Stephen's-green.*

ANNUAL MEMBERS.

Elected.
1861. 1. Andrews, William, *The Hill, Monkstown.*
1831. 2. Apjohn, James, M. D., F R. S., *South-hill House, Blackrock.*
1857. 3. Baily, W. H., F. G. S., 51, *Stephen's-green.*
1857. 4. Bandon, Earl of, *Castle Bernard, Bandon, Co. Cork.*
1859. 5. Barker, John, M. B., 64, *Waterloo-road.*
1861. 6. Barrington, C. E., *Fassaroe, Bray.*
1855. 7. Barton, H. M., 5, *Foster-place.*
1861. 8. Barton, John, *Stone House.*
1859. 9. Battersby, Francis, M. D., *Warrington-place.*
1844. 10. Bective, Earl of, *Headford, Kells.*
1858. 11. Bermingham, J., *Millbrook, Tuam.*
1861. 12. Blake, E. H., *Farmers' Club, Sackville-street.*
1857. 13. Bolton, George, Jun., 6, *Ely-place.*
1861. 14. Bolton, H. E., *Fitzwilliam Lodge, Blackrock.*
1831. 15. Brady, Right Hon. Maziere, Chancellor, 26, *Upper Pembroke-street.*
1861. 16. Browprigg, W. B., 18, *Adelaide-road.*
1840. 17. Callwell, Robert, M. R. I. A., 25, *Herbert-place.*
1857. 18. Carte, Alexander, A. M., M. D., *Royal Dublin Society.*
1858. 19. Cotton, Charles P., C. E., *G. S. & W. R., Nenagh.*
1834. 20. Croker, Charles P., M. D., 7, *Merrion-square, West.*
1846. 21. D'Arcy, Matthew, M. R. I. A., *Anchor Brewery, Ussher-street.*
1861. 22. Dickinson, Sir D. J., *Mountjoy-place.*
1849. 23. Downing, Samuel, C.E., LL. D., 6, *Trinity College.*
1832. 24. Dublin, The Archbishop of, *The Palace, Stephen's-green.*
1852. 25. Doyle, B. J., *Martello-terrace, Sandymount.*
1853. 26. De Vesci, Lord, *Abbeyleix House, Abbeyleix.*
1856. 27. Fleming, Lionel J., C. E., 2, *Henrietta-street.*
1857. 28. Frith, R. J., C. E., *Leinster-road, Rathmines.*
1858. 29. Gages, Alphonse, M. R. I. A., 51, *Stephen's-green.*
1849. 30. Galbraith, Rev. Joseph A., F. T. C. D., *Trinity College.*
1856. 31. Ganley, Patrick, 6, *Ely-place.*
1861. 32. Gillespie, W., 24, *Merrion-street.*
1861. 33. Greene, F. W., 46, *Dame-street.*
1859. 34. Green, Murdock, 52, *Lower Sackville-street.*
1831. 35. Griffith, Sir R., Bart., LL. D., 2, *Fitzwilliam-place.*
1852. 36. Gordon, Samuel, M. D., 11, *Hume-street.*
1856. 37. Good, John, *City-quay.*
1857. 38. Hampton, Thomas, C. E., 6, *Ely-place.*
1848. 39. Harvey, Professor, M. D., F. R. S., 40, *Trinity College.*
1861. 40. Hone, Joseph, Jun., 35, *Lower Leeson-street.*
1861. 41. Hudson, A., M. D., *Merrion-square.*
1861. 42. Humphrey, H. T., *Woodview, Merrion-avenue.*
1861. 43. Hutton, E., M. D., 5, *Merrion-square.*
1834. 44. Hutton, Thomas, F. G. S., 116, *Summer-hill.*
1852. 45. Jellett, Rev. Professor, F. T. C. D., M. R. I. A., 6, *Trinity College.*
1842. 46. Jennings, F. M., M. R. I. A., F. G. S., *Brown-street, Cork.*
1861. 47. Johnston, C. F., 9, *Eustace-street.*
1858. 48. Jones, William, C. E., 6, *Ely-place.*
1861. 49. Joy, R., 33, *Mountjoy-square.*
1856. 50. Kinahan, J. R., M. D., M. R. I. A., F. L. S., *St. Kilda, Sandycove, Dalkey.*
1853. 51. Kingsmill, Thomas W., Jun., *Sidmonton, Bray.*
1861. 52. Lewis, W., C. E., 13, *Nelson-street.*
1861. 53. Lisabe, F., C. E., 42, *Sackville-street.*
1831. 54. Lloyd, Rev. Humphrey, D. D., F. T. C. D., 35, *Trinity College.*
1861. 55. Lyster, J., C. E., *Stillorgan Lodge, Stillorgan.*
1855. 56. M'Causland, Dominick, 12, *Fitzgibbon-steeet.*

Elected.
1861. 57. M'Comas, A., 23, *Rathmines-road.*
1851. 58. M'Donnell, John, M. D., 4, *Gardiner's-row.*
1852. 59. Mac Donnell, Rev. Richard, D. D., Provost of Trinity College, *Provost's House, Trinity College.*
1837. 60. Mollan, John, M. D., 8, *Fitzwilliam-square, North.*
1851. 61. M'Dowell, George, F. T. C. D., 6, *Trinity College.*
1859. 62. Moore, Joseph Scott, *The Manor, Kilbride, Co. Dublin.*
1861. 63. Morris, T. B., *Oaklands, Sandymount.*
1831. 64. Nicholson, John, M. R. I A., *Balrath House, Kells.*
1856. 65. O'Brien, Octavius, 23, *Kildare-street.*
1832. 66. Patten, John, *Royal Dublin Society.*
1861. 67. Patterson, B. T., C. E., 206, *Brunswick-street.*
1843. 68. Petherick, John, *Surbiton, Kingston-on-Thames, Surrey.*
1857. 69. Porter, William, C. E., *Leinster Club, Leinster-street.*
1861. 70. Ryan, George, 32, *Frederick-street.*
1857. 71. Reeves, R. S., 22, *Upper Mount-street.*
1861. 72. Roberts, W. G., *Ballinapark, Ovoca.*
1852. 73. Smith, Robert, M. D., 63, *Eccles-street.*
1852. 74. Sanders, Gilbert, M. R. I. A., 2, *Foster-place.*
1854. 75. Scott, Robert H., A. M., 13, *Suffolk-street.*
1857. 76. Stack, Rev. Thomas, F. T. C. D., *Trinity College.*
1859. 77. Stokes, William, M. D., *Merrion-square.*
1861. 78. Stoney, Bindon, C. E., 89, *Waterloo-road.*
1857. 79. Tait, Alexander, C. E., *Santry.*
1859. 80. Waldron, L., M. P., LL. D., *Ballybrack, Dalkey.*
1859. 81. Walker, William F., 9, *Trinity College.*
1832. 82. Wall, Rev. C. W., D. D., Vice-Provost, *Trinity College.*
1857. 83. Welland, W. T., 48, *Upper Rutland-street.*
1859. 84. Wilde, W. R., F. R. C. S. I., 1, *Merrion-square.*
1851. 85. Wright, Edward, LL. D., M. R. I. A., *Floraville, Donnybrook.*
1853. 86. Wright, E. Perceval, M. D., A. M., F. L. Z. SS., *Museum, Trinity College.*

ASSOCIATES FOR THE YEAR.

1. Bateman, C. W., *Camden-street.*
2. Barnardo, J., *Dame-street.*
3. Dickinson, J., *Mountjoy-place.*
4. Doyle, M., *Martello-terrace, Sandymount.*
5. Glenny, T., 25, *Gloucester-street.*
6. Heath, C., 2, *Synnot-place.*
7. Jameson, J., *Portmarnock, Malahide.*
8. Jones, R. J., *Drogheda Railway Company.*
9. Knapp, W., 6, *Belgrave-square.*
10. Livesey, Thomas, 16, *Ranelagh-road.*
11. Owen, W. E., 30, *Trinity College.*
12. Quinton, E. T., 25, *Leinster-road.*
13. Russell, G., *Glenageary-hill.*
14. Shillington, H., 17, *Grantham-street.*
15. Scott, J. M., *Trinity College.*

No. II.

MEMBERS GAINED.

HONORARY MEMBER.

1. M'Clintock, Sir Leopold, R. N.

MEMBERS WHO HAVE PAID FULL LIFE COMPOSITION.

1. Armstrong, Andrew, *Claddagh, Bray.*
2. Connolly, J., *Kilmore, Artane.*
3. Hone, Thomas, *Yapton, Monkstown.*

MEMBERS WHO HAVE PAID HALF LIFE COMPOSITION.

1. Busteed, Dr., *Castle Gregory, Tralee.*
2. Harte, W., C. E., *Donegal.*
3. Whitney, C. J., *Roscarberry, Co. Cork.*

ANNUAL MEMBERS.

1. Blake, E. H., *Farmers' Club, Sackville-street.*
2. Bolton, H. E., *Fitzwilliam Lodge, Blackrock.*
3. Dickinson, Sir D. J., *Mountjoy-place.*
4. Hudson, A., M. D., *Merrion-square.*
5. Humphrey, H. T., *Woodview, Merrion-avenue.*
6. Johnston, C. F., 9, *Eustace-street.*
7. Lewis, W., C. E., 13, *Nelson-street.*
8. Patterson, B. T., C. E., 206, *Brunswick-street.*

MEMBERS LOST.

DECEASED.

Life Members.

1. King, John, *Dame-street.*
2. Jones, Rev. H. H., *Adare, Co. Limerick.*
3. M'Adam, James, 10, *College-street, Belfast.*

Annual Members.

4. Farran, Charles, M. D., *Feltrim, Malahide.*
5. Gyles, A. M'Gwire, *Enniscorthy.*

RESIGNED.

6. Craig, G. A., *Ely-place.*
7. Foot, William, *Rutland-square.*
8. Longfield, Rev. George, *Trinity College.*
9. Waller, J. F., LL. D., *Herbert-street.*

SUBSCRIPTIONS IN ARREAR.

10. M'Guire, Thomas, *Kildare-street.*
11. O'Grady, M. T., *Blessington-street.*
12. Robinson, Hartstonge, *Malahide.*
13. Smith, George, *College-green.*

State of the Society at the commencement of—

	Year 1861.	Year 1862.
Honorary Members,	11	12
Corresponding do.,	6	6
Life do.,	68	72
Annual do.,	89	86
	174	176

No. III.

DONATIONS RECEIVED TO 31st JANUARY, 1862.

Albany.—Annual Report of the Trustees of the New York State Library. 42 and 43. Presented by the State Library.

——— Guide to the Geology of New York and to the State Library. Presented by the State Library.

——— Annual Reports of the Regents of the University of the State of New York. 73 and 74. Presented by the State Library.

——— Annual Reports of the Regents of the University of New York on the Condition of the Cabinet of Natural History. 12, 13, and 14. Presented by the State Library.

Berlin.—Zeitschrift für die Gesammten Naturwissenchaften, Vols. XIII., XIV. Presented by the Editors.

——— Zeitschrift für Allgemeine Erdkunde, Nos. 87 to 100. Presented by the Geographical Society.

——— Zeitschrift der Deutschen Geologischen Gesellschaft, Vols. I. to XII. Presented by the Geological Society.

Boston.—Journal of the Boston Natural History Society, Vol. VII., Parts 1, 2, 3; Vol. VIII., Part 1; and Proceedings, pp. 145–240. Presented by the Society.

Brussels.—Annuaire de l'Academie Royale, 1861. Presented by the Academy.

——— Bulletin de l'Academie Royale, Nos. 9, 10. Presented by the Academy.

Calcutta.—Annual Report of the Geological Survey of India, 1859–60. Presented by Professor Oldham.

——— Memoirs of the Geological Survey of India, Vol. II., Part 2. Presented by the Survey.

Canada.—The Canadian Journal of Industry, Science, and Art, Nos. 31 to 36. Presented by the Editors.

——— Reports of Progress for 1853, 4, 5, and 6 of the Geological Survey of Canada, and a Volume of Plans thereto appended. Presented by Alderman Thomas Martin.

Cornwall.—Annual Report of the Royal Cornwall Polytechnic Society, 1860. Presented by the Society.

Dijon.—Memoirs de L'Academie Impériale de Dijon, 11 Vols., 1st Series; 7 do., 2nd Series. Presented by the Academy.

——— Monograph of the Genus Glyptodon, by M. D. Nodot. Presented by the Academy.

Dublin.—The Dublin Quarterly Journal of Science, Nos. 1 to 4. Presented by the Editor.

——— Journal of the Royal Dublin Society, Nos. 1 to 23. Presented by the Society.

——— The Atlantis, Nos. 1 to 6. Presented by Professor Sullivan, the Editor.

——— Proceedings of the Royal Irish Academy, Vol. VII., Parts 1 to 12. Presented by the Academy.

——— Proceedings of the Dublin University Zoological and Botanical Association, Vol. II., Part 1. Presented by the Association.

——— 5 Quarter Sheets and 2 Sections of the Geological Survey of Ireland, and 5 Books of Data. Presented by Sir R. Murchison, Director-General.

Dublin.—On a New Barometric Formula for Mountain-Heights, &c., by Henry L. Renny, M. R. I. A. Presented by the President, the Rev. S. Haughton.

——— On the Constants of the Barometric Formula, by Henry L. Renny, M. R. I. A. Presented by the President, the Rev. S. Haughton.

——— On the Genus Oldhamia, by Dr. Kinahan. Presented by the President, the Rev. S. Haughton.

——— On the Intensity of the Earth's Magnetic Force, by the Rev. H. Lloyd, D. D. Presented by the President, the Rev. S. Haughton.

——— On the Light reflected and transmitted by thin Plates, by the Rev. H. Lloyd, D.D. Presented by the President, the Rev. S. Haughton.

——— On the Radiation of Heat by Gases and Vapours, by Professor Tyndal. Presented by the President, the Rev. S. Haughton.

——— On the Occurrence of Flint Implements associated with the Remains of extinct Species, by J. Prestwich, F. G. S. Presented by the President, the Rev. S. Haughton.

——— On the Lifting Power of the Electric Magnet, by the Rev. T. R. Robinson, D.D., Part 3. Presented by the President, the Rev. S. Haughton.

——— The Blowpipe Vade Mecum, deduced from the original Observations of Dr. Aquilla Smith; edited by the Rev. S. Haughton, F. T. C. D., and R. H. Scott, M. A. Presented by the Editors.

Edinburgh.—Transactions of the Scottish Society of Arts, Vol. VII., Part 1. Presented by the Society.

Glasgow.—Proceedings of the Philosophical Society, Vol. V., Part 1. Presented by the Society.

Kilkenny.—Proceedings and Papers of the Kilkenny and South-East of Ireland Archæological Society, Nos. 28 to 34. Presented by the Society.

Königsberg.—Schriften der Königlichen Physikalisch-Oekonomischen Gesellschaft, 1860–61, Vol. I., Parts 1 and 2. Presented by the Society.

Lausanne.—Bulletin de la Société Vaudoise des Sciences Naturelles, No. 47. Presented by the Society.

Leeds.—Annual Report of the Leeds Philosophical and Literary Society, 1860–61. Presented by the Society.

——— Proceedings of the Geological and Polytechnic Society of Yorkshire, 1860. Presented by the Society.

Liverpool.—Proceedings of the Literary and Philosophical Society, No. 15. Presented by the Society.

——— Transactions of the Historic Society of Lancashire and Cheshire, No. 11. Presented by the Society.

London.—Quarterly Journal of the Geological Society, Nos. 65 to 68. Presented by the Society.

——— Proceedings of the Royal Geographical Society, Vol. V., Parts 1 to 5; Vol. VI., Part 1. Presented by the Society.

——— Journal of the Royal Geographical Society, Vol. XIII. Presented by the Society.

——— Catalogue of the Library of the Royal College of Surgeons, Nos. 1 to 4. Presented by the Council.

——— Notices of the Proceedings of the Royal Institute of Great Britain, Part 11. Presented by the Institution.

——— Proceedings of the Royal Society, Nos. 43, 44, 45. Presented by the Society.

——— Abstracts of the Philosophical Transactions and the Proceedings of the Royal Society, Vols. I. to X., ; pp. 1–392, Vol. XI. Presented by the Society.

——— Report of the British Association, Oxford, 1860. Presented by the Association.

——— Proceedings of the Zoological Society, Parts 1, 2, 3. Presented by the Society.

——— Journal of the Proceedings of the Linnean Society, Vol. V., Parts 18 to 21, and 1 and 2, Supplement to Botany. Presented by the Society.

——— Instructions for taking Meteorological Observations, by Colonel Sir H. James, R. E. Presented by the Secretary of State for War.

Manchester.—Transactions of the Manchester Geological Society, Nos. 4 to 9. Presented by the Society.

Montreal.—The Canadian Naturalist and Geologist, and Proceedings of the Natural History Society of Montreal, Nos. 1 to 5. Presented by the Society.

Munich.—Magnetische Ortsbestimmungen in Baiern, &c. (Lamont), Vols. I. and II. Presented by the Royal Academy of Munich.

——— Abhandlungen der Math-Physik; Classe. Vol. VIII., Parts 1, 2, 3. Presented by the Royal Academy of Munich.

——— Sitzungs-berichte der K. Baier. Akad. der Wissenschaften zu München, Parts 3, 4, and 5, 1860; Parts 2 and 3, 1861. Presented by the Royal Academy of Munich.

——— Almanach der K. B. Akad. 1859. Presented by the Royal Academy of Munich.

——— Monumenta Secularia de 2ten Classe (Untersuchungen über die Lichtstärke der Planeten) von Seidell. Presented by the Royal Academy of Munich.

Newhaven.—The American Journal of Science and Art, Nos. 91 to 96. Presented by the Editors.

New York.—Second Annual Report of the Trustees of the Cooper Union for the Advancement of Science and Art. Presented by the Trustees.

Philadelphia.—Proceedings of the Academy of Natural Sciences, pp. 285–579. Presented by the Academy.

——— A Notice of the Origin, Progress, and present Condition of the Academy of Natural Sciences of Philadelphia. By W. W. Rushenberger, M. D. Presented by the Academy.

——— Transactions of the American Philosophical Society, Vols. I. to IX. Presented by the Society.

Plymouth.—Annual Report of the Plymouth Institute, and Devon and Cornwall Natural History Society. Presented by the Society.

St. Louis.—Transactions of the Academy of Sciences of St. Louis, Vol. I., No. 4. Presented by the Academy.

Vienna.—Jahrbuch der K. K. Geologischen Reichsanstalt, 1859, Nos. 1 and 2; and 1860, No. 2. Presented by the Editor.

Washington.—Report of the Superintendent of the Coast Survey, U.S.A., for 1858. By Professor A. D. Bache. Presented by the Smithsonian Institution.

——— Researches upon the Venom of the Rattlesnake. By S. W. Mitchell, M. D. Presented by the Smithsonian Institution.

——— Second Geological Report of Arkansas. Presented by the Smithsonian Institution.

——— Annual Report of the Smithsonian Institution. Presented by the Institution.

——— Meteorological Observations made at Providence, R. I. By Alexis Caswell, Esq. Presented by the Smithsonian Institution.

——— Meteorological Observations made near Washington. By N. D. Smith, M. D. Presented by the Smithsonian Institution.

——— On the Fluctuation of Level in the North American Lakes. By C. Whitlesey. Presented by the Smithsonian Institution.

Presented by the Authors.

Austin.—On a new Genus of Echinoderm. By Fort-Major Austin, F. G. S.

Daubree.—Papers on the Possibility of Capillary Infiltration through porous Rocks. By M. Daubree.

De Serres.—Des Espéces Perdues et des Races qui ont Disparu, &c.

——— Des Formations Volcaniques de l'Ardèche.

——— De Quelques Particularités des Formations Volcaniques, &c.

——— Des Alterations que les Coquilles eprouvent pendant la Vie des Animaux que les habitent, et même apres leur Mort.

——— Des Ossements Humains des Cavernes, &c.

——— De la Classification Mineralogique des Metaux, &c.

——— Tableau des Roches Plutoniques composées, &c.

——— Des Particularités des Terrains Tertiaires, &c.

De Serres.—Des Rapports et des Differences des Terrains Crétaces du Nord, et du Midi de France.

——— Des Houilles Sèches ou Maigres, nommées Stipites.

——— En Response au Memoire de M. Lacour sur l'Origine chez un Peuple Noir et Africain, de la langue Hebraique, &c. By Marcel de Serres.

Felton.—A Stratigraphical Account of the Section from Atherfield to Rocken, and on the S. W. Coast of the Isle of Wight. By W. H. Felton, M. D., F. R. S.

Horner.—Address delivered at the Anniversary Meeting of the Geological Society of London. By Leonard Horner, Esq., F. R. S., President.

Kinahan.—On the Britannic Species of Crangon and Galathea. By J. R. Kinahan, M.D.

Murchison.—Address delivered to the Geological Section of the British Association at Manchester, 1861. By Sir R. Murchison.

No. IV.

SOCIETIES AND INSTITUTIONS ENTITLED TO RECEIVE THE JOURNAL OF THE GEOLOGICAL SOCIETY OF DUBLIN.

ABERDEEN, .	University Library.
ALBANY, . .	State Library, New York.
AMSTERDAM, .	Royal Academy of Sciences.
BELFAST, . .	Queen's College Library.
BERLIN, . .	Royal Academy of Sciences.
	German Geographical Society.
	German Geological Society, per Bessersche Buchhandlung, *Behren-str.*, 7, *Berlin.*
BORDEAUX, .	Imperial Academy of Sciences.
BOSTON, . .	American Academy.
	Natural History Society.
BRISTOL, . .	Institution for the Advancement of Science, Literature, and the Arts.
BRUSSELS, .	Academy of Sciences.
CALCUTTA, .	Public Library.
	Geological Survey of India.
CAMBRIDGE, .	Philosophical Society.
	University Library.
COPENHAGEN,	Royal Society of Science.
CORK, . . .	Queen's College Library.
	Royal Institution.
CORNWALL, .	Royal Polytechnic Institution.
DIJON, . . .	Academy of Sciences.
DUBLIN, . .	Royal College of Surgeons' Library.
	Royal Irish Academy.
	University Library.
	Royal Dublin Society.
	Natural History Society.
	Ordnance Survey Library.
	Professor Sullivan, as Editor of the "Atlantis."
	Geological Survey of Ireland.
	University Philosophical Society.
	University Zoological and Botanical Association.

EDINBURGH, .	Royal Society.
	Wernerian Society.
	Society of Arts.
	University Library.
	Society of Antiquaries.
FLORENCE, .	Society of Physics and Natural History.
GALWAY, . .	Queen's College Library.
GENOA, . .	Society of Physics.
GLASGOW, . .	University.
GÖTTINGEN, .	University.
HANAU, . .	Oberhessische Gesellschaft der Natur-und Heil-kunde.
HANOVER, .	Royal Library
KILKENNY, .	Archæological Society.
KÖNIGSBERG,	Königlich Physikalisch-Oekonomische Gesellschaft.
LAUSANNE, .	Société Vaudois des Sciences Naturelles.
LEEDS, . .	Geological and Polytechnic Society of the West Riding of Yorkshire.
	Philosophical and Literary Society.
LEIPZIC, . .	Royal Society of Sciences (Saxony).
	University.
LIVERPOOL, .	The Literary and Philosophical Society.
	Historic Society of Lancashire and Cheshire.
LONDON, . .	Geological Survey, *Jermyn-street.*
	British Museum.
	Society of Arts, *John-street, Adelphi.*
	Royal Institution, *Albemarle-street.*
	Royal Society, *Burlington House.*
	Geological Society, *Somerset House.*
	Linnean Society, *Burlington House.*
	Geographical Society, 15, *Whitehall-place.*
	Civil Engineers, Institution of, 25, *Great George's-street, Westminster.*
	Royal Asiatic Society, 5, *New Burlington-street.*
	Royal College of Surgeons.
	Zoological Society, 11, *Hanover-square.*
	Athenæum, 14, *Wellington-street, Strand, W. C.*
	Literary Gazette.
LYONS, . .	La Société Impériale d'Agriculture, d'Histoire Naturelle, et des Arts Utiles.
	Société Linnéen.
	Academie Impériale.
MADRID, . .	Academia de Ciencias.
MANCHESTER,	Literary and Philosophical Society of. [Sec., R. C. Christie.]
	Geological Society.
MELBOURNE, .	Philosophical Institute of Victoria.
MILAN, . .	Reale Instituto Lombardo di Scienzi.
MISSOURI, . .	State Survey and University, *Geological Rooms, Columbia, U. S. A.*
MODENA, . .	Imperial Institute of Science.
MONTREAL, .	Natural History Society.
MUNICH, . .	Royal Academy of Science (2 copies).
NEUCHATEL, .	Société des Sciences Naturelles.
NEW HAVEN,	The Editors of Silliman's Journal of Science and Art.
OXFORD, . .	Bodleian Library.
	Ashmolean Society.
PARIS, . .	Ecole Polytechnique.
	Geological Society.
	L'Ecole Impériale des Mines.
	Institute of France.
	Bibliothéque Impériale.
	Jardin des Plantes, Bibliothéque.

PHILADELPHIA,	American Philosophical Society.
	Natural History Society.
PLYMOUTH, .	Plymouth Institution and Devon and Cornwall Natural History Society.
QUEBEC, . .	Literary and Historical Society.
ROME, . . .	The Vatican Library.
ROUEN, . .	Academy of Science.
ST. ANDREWS,	University Library.
ST. LOUIS, . .	Academy of Sciences.
ST. PETERSBURG,	Imperial Academy.
	Central Physical Observatory of Russia.
STOCKHOLM, .	Royal Academy of Science.
STRASBOURG, .	Société des Sciences Naturelles.
TORONTO, C.W.,	Canadian Institute, per Thomas Henning, Esq.
TOULOUSE, .	Academy of Sciences.
TURIN, . .	Royal Academy.
UPSALA, . .	Royal Society of Sciences.
VIENNA, . .	Imperial Academy of Sciences.
	Prof. W. Haidinger, of Vienna, as Editor of the "Jahrbuch der K. K. Geologischen Reichs-anstalt."
WASHINGTON,	Smithsonian Institute Library, per Henry Stevens, Esq., *Morley's Hotel, Trafalgar-square, London.*

No. V.—ABSTRACT OF TREASURER'S ACCOUNT FOR THE YEAR ENDED DECEMBER 31, 1861.

Dr.—1861.		£ s. d.
To Balance from last year's Account,		30 10 10
— Amount of Subscriptions received for year ending December 31, 1861:—		
— Life Composition,	£20 0 0	
— Half-life Compositions,	15 0 0	
— Admission Fees,	8 0 0	
— Annual Subscriptions,	68 0 0	
		111 0 0
		£141 10 10

Cr.—1861.		£ s. d.
— Assistant Secretary's half-year's Salary, to June 30, (per Draft 541),		10 0 0
— Sundries, per Assistant Secretary, (per Draft 542),	7 0 9	
— Porter's Wages,	7 10 0	
— Gratuity to Attendant,	1 10 0	
— Carriage of Books,	1 11 5	
		17 12 2
— Mr. Gill, for Printing for one year, to Dec. 18 (per Draft 543),		8 16 2
— Sundries, per Assistant Secretary (per Draft 544),	2 14 6	
— Porter's Wages,	6 11 3	
— Carriage of Books,	0 18 0	
— Mr. Foster's Account for Lithographs,	2 18 9	
— Mr. Keogh, for Binding,	1 16 6	
— Mr. Tallon's Account for Stationery,	1 19 6	
		16 18 6
— Assistant Secretary, Salary to December 31, 1861, (per Draft 545),		10 0 0
— Mr. Gill, on Account of Printing Journal of the Society, Vol. IX., Part 1 (per Draft 546),		*50 0 0
		£113 6 10
— Balance in Bank,	£23 4 0	
— Cash in hands,	5 0 0	
		28 4 0
		£141 10 10

* Balance in Bank and hands,	£28 4 0
Of this Account of Mr. Gill's there is a portion still due, amounting to	26 5 3
Nett Balance to next year,	£1 18 9

Jan. 30, 1862.

GILBERT SANDERS, *Treasurer*.

The ballot having closed, the following gentlemen were declared duly elected:—

President.—Rev. Professor Haughton, F.T.C.D., F.R.S.

Vice-Presidents.—Robert Mallet, C.E., F.R.S.; James Apjohn, M.D., F.R.S.; Rev. H. Lloyd, D.D., F.R.S.; Lord Talbot de Malahide; Sir Richard Griffith, Bart., LL.D.

Treasurers.—Gilbert Sanders, Esq.; F. J. Sidney, LL.D.

Secretaries.—George MacDowell, M.A., F.T.C.D.; Robert H. Scott, M.A.

Council.—Robert Callwell, Esq.; John Kelly, Esq.; John B. Doyle, Esq.; J. R. Kinahan, M.D., F.L.S.; Alexander Carte, M.D.; Samuel Gordon, M.D.; Wm. H. Baily, F.G.S.; Alphonse Gages, M.R.I.A.; R. S. Reeves, Esq.; Rev. Joseph A. Galbraith, F.T.C.D.; William Andrews, Esq.; Joseph Beete Jukes, M.A., F.R.S.; E. Perceval Wright, M.A., M.D., F.L.Z.SS.; B. B. Stoney, C.E.; John Barker, M.B.

The Rev. Samuel Haughton (President) proceeded to deliver the following

ANNUAL ADDRESS.

Gentlemen,—In offering you my congratulations at the close of another year of activity and usefulness, on the part of the Geological Society of Dublin, which I have the honour to represent, I have to deplore the unusual number of deaths that have occurred amongst us during the past year.

Mr. John King, who so ably conducted the editorial department of "Saunders' News-Letter" for many years, and was so well and favourably known in every relation of domestic and social life, succumbed, during the course of the past year, to an illness which had long impaired his health, and against whose depressing influences he had cheerfully contended for many months.

The Rev. Henry Hampden Jones, who died during the past year, was early lost to science, and to a higher and holier cause, in the faithful discharge of the duties of which he contracted the fever by which he lost his life. He was known among us by his zeal as a collector of fossils, in which pursuit he was most successful, and has left a monument of his industry, in the discovery of a new and unique Echinoderm of the carboniferous limestone of the county of Limerick, described in the Journal of this Society.

Mr. James M'Adam, of Belfast, joined our Society in 1832, and was one of our original members. He died in June, 1861, after a protracted illness. I gladly reproduce to you the following sketch of his career, drawn by one of his fellow-townsmen, who only speaks of him in those terms of praise, which all who knew him would willingly use:—

"James M'Adam was born in Belfast in January, 1801. After the early years of boyhood were passed, he entered the school then taught

by James Sheridan Knowles, and was, under the auspices of that gentleman, transferred to the Academical Institution of Belfast, on its opening, in 1814. There his school education was completed, and studies of a higher order commenced. He afterwards became a graduate of the University of Dublin, being at the same time busily engaged in mercantile pursuits, and snatching from the intervals of recreation the time required for the preparation of his collegiate course.

"He had a peculiar facility in the acquisition of foreign languages, and throughout his life took pleasure in the perusal of scientific works or periodicals published on the Continent. But science, not literature, was his favourite pursuit; and he especially devoted himself to the study of mineralogy and geology, particularly the geology of the counties of Down and Antrim. His collection of fossils, illustrative of this district, is very valuable and extensive, and will, we hope, be yet applied to the furtherance of the object for which it was intended.

"It was natural that he should be associated with men of science engaged in similar pursuits; he became, therefore, a member of the Geological Societies of Dublin and of London. His published papers have appeared in the pages of scientific periodicals, and the proceedings of societies. Some of them, devoted to the geology of parts of Ireland, have been translated into German.

"In his own town, he was ever ready to promote the advancement and the diffusion of scientific knowledge. He was one of the original members of the Natural History Society of Belfast, founded in 1821, and for forty years continued to take an active part in all its affairs. His fellow-members showed their appreciation of his services by electing him their President in 1860, which office he held at the period of his death. He was one of those by whom the Botanic Gardens were established, and for a number of years he acted as Secretary of the Royal Academical Institution.

"Towards the close of the year 1858, he delivered in the Museum, and for the benefit of that institution, a course of lectures on geology, which were largely attended, and did much to excite a desire in Belfast for the further prosecution of the study of that branch of science.

"Of his kindly disposition, and of those qualities that made him beloved in private life, we presume not to speak. We have confined ourselves to what pertains more properly to the development and progress of his character as a man of science. Such of our readers as knew him not, and read here this imperfect sketch of his various labours, may fancy that he was a scientific recluse, living in this stirring town, but taking no part in the bustle of commercial life. Such, however, was not the case; he was the senior partner in one of our large manufactories, and sedulous in his attention to those daily duties that a life of business demands. But with him the cultivation of the intellect was never abandoned; science and trade were united; and our valued townsman, whose death we now deplore, gives us another example of those qualities and attainments which exercise an elevating influence on a mercantile community."—*Northern Whig.*

Dr. Charles Farran was better known among us as a naturalist than as a geologist. He was a most distinguished member of the Natural History Society of Dublin, which has contributed to Natural Science so many distinguished names.

He joined that Society at an early period of its existence, and during his membership he contributed many papers to its meetings, which may be found in its printed proceedings; he also presented several rare mollusks, crabs, and fishes to its collection. Of his original discoveries, the most important will be found to have been among the mollusks. Of his valuable papers, the following may be enumerated:—

1. On the discovery of *Bulla hydatis*.
2. On localities for *Helix piscinii*.
3. On the Pholadidæ and Lithodomi of the coast of Waterford (2 papers).
4. On *Pectunculus Glycimeris*.
5. On a *Teredo Norvegica*. On *Akera bullata*.
6. On the discovery of *Limneus glaber*.
7. On a new species of Pentactes.
8. On the genus Skua.
9. On the Turnstone.
10. On the marbled swimming Crab.
11. On the Sprat fisheries on the coast of Waterford.

The Venerable Archdeacon Verschoyle, who died within the last few days, at the advanced age of 82 years, became a member of this Society in 1834, and was well known as a distinguished geologist by the publication, in 1832, of his paper on the Geology of the North Coasts of the counties of Mayo and Sligo, in the Transactions of the Geological Society* of London, at a time when many of those I now address were either learning to walk, or painfully making themselves acquainted with the mysteries of Latin Grammar and the Rule of Three.

His description of the dykes of the north coast of the county of Mayo remains as yet the only description which we possess of that remarkable country; and I am not certain that even our geological surveyors, when they come to describe that remote district, will find themselves obliged to correct much of what he has written, or compelled to add more to it than they have already done to other parts of the South and West of Ireland.

In former Addresses to this Society, I have invited your attention to various astronomical theories of the original formation of our planet, of the internal heat of the globe at present, and of the causes of change of climate; and in my last Annual Address I endeavoured to present to you

* Trans. Geol. Soc., London, 2nd Series, vol. v., p. 149.

my views of the physical causes of the elevation of our great mountain chains, and of the depression of our deep-sea valleys.

On the present occasion I purpose to follow up my former Addresses, by giving you my views as to the mineralogical and chemical composition of the rock masses of which the earth is composed; and, in so doing, I shall carefully distinguish my own speculations from the numerous and well-ascertained facts observed by myself and others, more especially the chemical geologists of Germany and France, in which countries, the physical and chemical laws at work among our rocks, and the physical history of our globe itself, receive that attention which their importance demands, and which they, in vain, solicit from the eyes and pens of English geologists.

I adopt as the fundamental hypotheses of the physical history of our globe the nebular theory of Laplace, and the physico-chemical hypothesis of Durocher, which supposes the two outer layers of our globe (on cooling from the molten conditions required by the hypothesis of Laplace), to have acquired their relative positions of outer and inner layer, not only by virtue of their relative specific gravities, but also in accordance with their definite chemical compositions; so that the specific gravity of each layer, which by the action of mechanical laws fixes its position in the earth, is itself the result of its chemical and mineralogical composition.

The hypothesis of Laplace is so well known, that I do not feel it necessary to describe it; but that of Durocher is so little known or understood, that I gladly avail myself of the present opportunity to offer it to you, as nearly as possible, in his own words:—

"An immense number of consequences may be logically derived from the following proposition, the proof of which I shall furnish presently, viz.:—*That all igneous rocks, modern and ancient, were produced by two Magmas, which coexist below the solid crust of the globe, and occupy there each a definite position.*

"The Upper Magma, which is rich in silica, and poor in earthy bases and oxides of iron, possesses the least specific gravity; and in this respect there are differences among the rocks produced by the two Magmas, from one and a half to twice as great as between oil and water. The separation is still greater if, in place of considering the rocks in their natural condition, we compare the vitrified products obtained by their fusion: further still, if we refer them to their liquid condition, there ought to be, according to Bischoff's experiments, between the rocks arising from the two Magmas, differences twice greater than those observed in their crystalline state, and, therefore, from three to four times greater than those between oil and water: from these facts may be deduced the necessary and permanent separation of the two Magmas.

"These two Magmas have undergone but slight changes of composition from the most remote geological epochs; and, moreover, they differ essentially from each other by means of well-defined characters. The one may, from its excess of silica, be called the Acid Magma; while the other is comparable to a basic salt; for its silica is not in sufficient

quantity to saturate its metallic oxides. The difference of silica in the two Magmas is in the proportion of 7 : 5. They contain nearly the same quantity of Alumina; but the Siliceous Magma contains from one and a half to twice as much alkalies, and more Potash than Soda, while the reverse occurs in the Basic Magma. The first is specially characterized by its poverty in earthy bases, and the iron oxides; of these, it contains from six to eight times less than the other.

"The following Table gives the composition of these Magmas, and the specific gravities of the rocks derived from them.

	Proportions of Elements.			
	Mean Proportions in the two Magmas.		General limits of Proportions in the Igneous Rocks.	
	1. Siliceous.	2. Basic.	1. Siliceous.	2. Basic.
Silica,	71·0	51·5	62 to 78	45 to 58
Alumina,	16·0	16·0	11 to 20	11 to 20
Potash,	4·5	1·0	3 to 6	½ to 3
Soda,	2·5	3·0	1 to 6	1 to 6
Lime,	1·0	8·0	½ to 2	5 to 12
Magnesia,	1·0	6·0	½ to 2	8 to 12
Oxides of Iron and Manganese,	2·5	13·0	½ to 4	7 to 20
Water, Fluorine, Carbonic Acid,	1·2	1·3	½ to 3	½ to 4
Specific gravity of Rocks, viz.—				
1st. Natural,	2·65	2·95	2·4 to 2·7	2·8 to 3·2
2nd. Vitrified artificially,	2·40	2·72	2·35 to 2·46	2·5 to 2·84

"By combining the results I have obtained by chemical and mechanical analysis with those of analyses already published by various mineralogists, I have established that igneous rocks of crystalline texture, and almost all compact or vitreous masses, formed by fusion, and wrongly considered as minerals, are derived from one or other of these Magmas. To the first are referable all the Granitic rocks, including the Eurites, Quartziferous Porphyrics, and Petrosilex, the Trachytes, Phonoliths, Perlites, Obsidians, Pumices, and Lavas, with Vitreous Feldspar. To the second belong the Diorites, Ophites, Euphotides, Hyperites, Melaphyres, Traps, Basalts, and Pyroxenic Lavas."—*Essay on Comparative Petrology, Annales des Mines*, vol. xi. 1857.

The two outer layers of our cooled globe to which Durocher applies the terms Acid and Basic Magma, respectively, may be conveniently designated as the First and Second Layers; and in one form or another, Durocher's hypothesis is now generally accepted by physical geologists. In its chemical view of the igneous rocks it is not original, as a similar proposal to regard all igneous rocks as the result of the mixture of two types of rocks was published long ago by Bunsen, and very generally adopted by German geologists; but in its physical view of these type rocks, as the outer and inner layers of the globe, by virtue of their relative specific gravities, it is Durocher's own, and justifies his claims

to be regarded as one of the most brilliant and ingenious of geological investigators. I adopt Durocher's speculation, as I do that of Laplace, as a convenient hypothesis, summing up in a form easily remembered a crowd of concurrent facts, and being as near an approach as the limited knowledge of man can make to probability, in the obscure region of science with which it deals.

It is impossible for us, however, to remain contented with an hypothesis as to the composition of the First and Second layers of our globe, without speculating also as to the composition of the Third and Fourth layers; and, although it must be admitted that the deeper we descend, the less basis we have for our speculations, I will venture to make an additional guess, at least, as to the composition of the Third, and even of the Fourth layer of our globe. If we examine the composition of the Acid and Basic Magmas of Durocher, with regard to the quantity of oxygen which they each contain, we shall find this difference, that the Acid Magma, or Outer Layer, contains 48·22 parts of oxygen in 100 parts of rock, while the Basic, or Inner Layer, contains only 43·60 parts per cent.* Now, we know from mining operations, that lodes, which are simply fissures in the ground, are filled with their mineral wealth from below, in the form of sulphurets, arseniurets, and other minerals, containing no oxygen whatsoever; while they owe their oxides, hydrates, carbonates, arseniates, and phosphates, to the oxidizing influences to which they are exposed from above. From this consideration alone, it would appear probable that below the region of Durocher's Basic Magma, there must exist in the earth a region, or layer, filled with sulphur salts of metals, into whose composition no oxygen enters. This conjecture is further confirmed by the consideration of the chemical composition of aeroliths, which, as is well known, may be divided into two classes, meteoric irons and meteoric stones, the former of which contain no oxygen, and the latter contain of oxygen a quantity (not more than 22 per cent.) much less than the per-centage of even the Basic Magma of Durocher. These meteorites, which are of interplane-

* *Quantity of Oxygen contained in the Acid and Basic Magmas.*

	Acid Magma.			Basic Magma.	
	Percentage.	Oxygen.		Percentage.	Oxygen.
Silica, ...	71·00	36·86	. . . .	51·50	26·50
Alumina, ...	16·00	7·47	. . . .	16·00	7·47
Potash, ...	4·50	0·76	. . . .	1·00	0·17
Soda, ...	2·50	0·64	. . . .	3·00	0·76
Lime, ...	1·00	0·28	. . . .	8·00	2·27
Magnesia, ...	1·00	0·40	. . . .	6·00	2·40
Iron (peroxide), . .	2·50	0·75	. . (Protoxide) . .	13·00	2·88
Water, ...	1·20	1·06	. . . .	1·30	1·15
Totals, . .	99·70	48·22		99·80	43·60

tary origin, must be admitted by those who adopt Laplace's nebular hypothesis to give us some evidence as to the composition of the interior of our own globe.

It may therefore be regarded as a speculation, in favour of which something may be said, that the first layers of our globe, in a descending order, are—

First Layer. — The Siliceous, or Acid Magma of Durocher.
Second Layer.—The Lime Magnesia and Iron, or Basic Magma.
Third Layer.—The region of the Sulphur and Arsenic Salts.
Fourth Layer.—The region of the Iron and Nickel Alloys.

If we turn our attention from the interior of the earth to its surface, we shall find a class of facts awaiting our attention, no less worthy of our notice. The envelope of our globe consists of water, oxygen, carbonic acid, and nitrogen; of which the two former are called on to play a most important part in the Mineral Kingdom, while it would be no exaggeration to assert that the presence of the two latter is the essential condition requisite to the possibility of the existence of the Vegetable and Animal Kingdoms, respectively.

In a planet whose atmosphere contained no oxygen, the most beautiful forms of the Mineral Kingdom would be wanting; the Sulphates, Phosphates, Silicates, could not exist; and unless water were present, as well as oxygen, our beautiful Zeolites, and other hydrated minerals, would be absent.

An atmosphere of oxygen and water alone might create the most beautiful forms which delight the mineralogist; but unless carbonic acid and nitrogen were added, there could be no mineralogist to admire the beauty of the minerals; without carbonic acid, no vegetation could exist, and without nitrogen no animal could live.

Linnæus has defined the limits of the three kingdoms of nature in his "Fundamenta Botanica," chap. 1, aphorism 3:—"*Lapides* crescunt; *Vegetabilia* crescunt et vivunt; *Animalia* crescunt, vivunt, et sentiunt."

With equal propriety, and with a deeper meaning we might say:—

Stones appropriate Oxygen and Water;
Plants ,, Carbonic Acid, Oxygen, and Water;
Animals ,, Nitrogen, Carbonic Acid, Oxygen, and Water—
Man does all, and is conscious that he does so.

A consideration of the stratified rocks of the globe confirms the opinion, that carbon is to be regarded as a product of the atmosphere, like oxygen, nitrogen, and hydrogen, and not as a mineral. We are acquainted with but two important origins for carbon, viz., our coal-beds and limestones. The former of these are confessedly the result of vegetable organic life, and derive their origin from the vital power possessed by the Vegetable Kingdom of obtaining carbonic acid from the atmosphere, fixing its carbon, and returning the oxygen to the air;—the latter source of carbon, limestone, owes its origin in great measure to the vital power possessed by Corals and other members of the

Animal Kingdom, of fixing carbonate of lime in their skeletons, and so gradually laying the foundation for the formation of beds of limestone. But from what source was the carbonate of lime derived? Durocher's theory of the Basic Magma supplies us with silicate of lime and magnesia in abundance; and it is certain that the decomposition of the rocks derived from this layer of the earth, by the action of an atmosphere containing carbonic acid and water, would furnish in abundance the limestones and dolomites that abound in the later periods of the earth's history.

Our atmosphere contains at present in 100 parts—

Of oxygen, ...	20·61
,, nitrogen, ...	77·95
,, carbonic acid, ...	0·04
,, water, ...	1·40
	100·00

In speculating on the primitive periods of the history of the globe, it is impossible not to believe that its atmosphere, containing as it did, in the form of carbonic acid, all the carbon now fixed in the earth as coal and limestone, must have had a composition widely different from that which now exists; and that this difference in chemical composition must have had, as Brongniart thought, an important influence in producing that extraordinary development of vegetation of a peculiar kind which characterises the period of the formation of the coal-beds.

In confirmation of the preceding theory, I may remark, that the absence of limestone-beds in the older rocks has attracted the notice of almost every geologist, no matter in what country they have been studied. This paucity of limestone rocks is easily accounted for, by the consideration of the fact that the denudation and erosion of the outer layer of the globe could only supply materials for the formation of slates and sandstones, and that the limestones could not be formed until the eruption of portions of the second layer supplied the lime and magnesia requisite for their formation.

Read by the light of this theory, the stratified rocks of the globe appear to me to be capable of being grouped into a chronological order, as natural as that which prevailed among the primitive igneous rocks, in which the granitic preceded the trap rocks, and these latter the volcanic rocks, by laws resulting from the mechanical and chemical conditions under which they necessarily assumed their relative positions in the crust of the globe.

If the foregoing views respecting the arrangement of the layers of the earth, according to their chemical composition and consequent specific gravity, be considered probable, one effect of their adoption must be to destroy the positive value of such speculations as those of Mr. Hopkins and Mr. Hennessey as to the thickness of the supposed solid crust of the globe. These speculations are essentially founded on the hypothesis of Legendre and Laplace, that the specific gravities of the different layers

of the globe depend only on the pressure to which they are subjected; and if the specific gravity should turn out to depend rather on the chemical composition of the layer than on its pressure, the law founded on the latter hypothesis would become worthless, and such speculations as I have alluded to, however ingenious as mathematical exercises, would cease to have a real value as applied to solve the problem of the thickness of the earth's crust.

I turn now, however, from this question, which appears to me impossible of solution, to the more important one of the Mineral and Chemical composition, and of the origin of Granite, which is regarded on Durocher's hypothesis as the outer layer of the globe, or Acid Magma.

Before inquiring, however, into the origin of granite, it is necessary to inquire what granite is; and it is strange that, even on so elementary a question, there should be a difference of opinion.

If we ask the opinion of Bunsen, or, at least, of his followers, they will tell us that granite is a mixture of 10 parts of his Normal Trachytic Rock, with 2 parts of his Normal Pyroxenic Rock, which have the following compositions:—

	Normal Trachytic Rock.	Normal Pyroxenic Rock.
Silica,	76·67	48·47
Alumina, } Iron (peroxide), }	14·23	30·16
Lime,	1·44	11·87
Magnesia,	0·28	6·89
Potash,	3·20	0·65
Soda,	4·18	1·96
	100·00	100·00

If we consult English geologists, they will give us the unsatisfactory information, that granite is composed of quartz, feldspar, and mica, without stating what feldspar or what mica is included in the definition, and that, if hornblende appear instead of mica, the rock ceases to be a granite, and should be called a syenite.

And, finally, if we ask the opinion of the highest authority on this subject (Gustavus Rose), he has informed us that the presence of Oligoclase, as well as of Orthoclase, is requisite to constitute a true granite.—Vide *Zeitschrift der Deutschen-Geologischen Gesellschaft*, vol. i. 1849.

Bunsen's definition of a granite is a mathematical fiction, the English definition has no precise meaning, and that of G. Rose is insufficient. Granite is not a mixture of two rocks; its minerals do not exclude Hornblende; nor do they necessarily include Oligoclase.

In Ireland, which is as rich a field for the study of the igneous rocks as England is for the study of the fossiliferous rocks, we have in Leinster a granite which contains quartz, orthoclase, margarodite, lepido-

melane, and a periclinic paste, as its constituent minerals. In the Mourne Mountains we have a granite containing quartz, orthoclase, albite, green mica, lepidomelane, and an undescribed paste; and in Donegal we find a granite containing quartz, orthoclase, oligoclase, margarodite, lepidomelane, and an unknown paste. These Irish granites are quinary, and even senary, in their composition, and are as truly granites as the pegmatite of Caernarvon, which is composed exclusively of quartz and orthoclase, and is binary in its composition.

What logicians would call the "essential difference" of granite appears to be "*a crystalline structure visible to the eye, and the presence of quartz and orthoclase.*"

Adopting this as our definition, granites may be classified as—

1. Binary, . . Quartz and orthoclase.
2. Ternary, . . Quartz, orthoclase, white mica.
3. Quaternary, . Quartz, orthoclase, white mica, black mica.
4. Quinary, . . *a.* Quartz, orthoclase, oligoclase, white mica, black mica.
   β. Quartz, orthoclase, oligoclase, black mica, hornblende.
   γ. Quartz, orthoclase, albite, black mica, hornblende.

In this classification, the residual paste is omitted.

I have purposely omitted Protogene from this classification of granites, as I believe no such rock as a granite composed of Quartz, Feldspar, and Talc exists. It is said to abound in the Alps and Cornwall; in both which localities, I can assert from personal observation, it does not occur. The following analyses of the so-called Protogene of Switzerland have been published:—

Protogene of the Alps.

	1	2	3	4	5	6	Mean.
Silica, ...	71·41	74·25	72·42	70·75	75·00	72·96	**72·80**
Alumina, ...	14·45	11·58	14·53	. .	12·90	14·00	**13·23**
Iron (peroxide), . . .	. .	*2·41		. .	1·10	2·42	**1·98**
Iron (protoxide), . .	2·58	. . .	. . .	. .	. . .	0·38	**1·48**
Manganese (protoxide),	. .	Trace.	. . .	. .	. . .	0·40	**0·40**
Lime, ...	2·49	1·08	1·03	1·08	1·26	1·12	**1·34**
Magnesia, ...	1·11	. .	. . .	. .	. .	0·14	**0·62**
Potash, ...	2·77	10·01	. . .	. .	9·34	4·47	**3·62**
Soda, ...	3·05	. .	. . .	. .	. .	4·33	**3·69**
Water, ...	1·25	0·67	. . .	0·71	0·40	. . .	**0·76**
	99·11	**100·00**	. . .	. .	**100·00**	**100·22**	**99·92**

* Iron in excess in this analysis, owing to trituration in an iron mortar.

No. 1. *Mont Blanc.* North side, 15,200 feet high.
Analysed by Schönfeld and Roscoe.—Ann. Ch. Phar. 91, 305: 1854.
Sp. gr. = 2·7088.

No. 2. *Mont Blanc.* Highest peak.
Analysed by Delesse.—Bull. Soc. Geol. (2.) 6, 246: 1849.
Sp. gr. = 2·72. Rich in grey Quartz; greyish-white Orthoclase; Oligoclase, greenish from the intermixed Talc; Mica, dark-green.

No. 3. *Mont Blanc.* Extremity of Mer de Glace.
Analysed by Delesse.—*Loc. cit.*
Sp. gr. undetermined. Quartz, feeble reddish-grey; Orthoclase and Oligoclase, white; Talc, clear green; Mica, dark-green; Ripidolite, sparingly mixed.

No. 4. *Mont Blanc.* Aiguille du Dru.
Analysed by Delesse and Ringuelet.—*Loc. cit.*
Sp. gr. undetermined. Quartz; white Orthoclase; Oligoclase; Talc, coloured.

No. 5. *Valorsine Thal*, on the road near Rupes.
Analysed by Delesse.—Bull. Soc. Geol. (2.), 7, 426: 1850.
Sp. gr. undetermined. Quartz; Orthoclase, greyish-white; Oligoclase, greenish-white; Mica, pinchbeck and white.

No. 6. *Mont Blanc.* 500 feet below summit, on north side.
Analysed by Haughton.—Journ. Geol. Soc. Dub., vol. ix., p. 219.
Sp. gr. = 2·671. Medium-grained Granite, of platy structure; Quartz, large and visible ($\frac{2}{10}$th in.), grey; translucent white Orthoclase, in crystals ($\frac{1}{4}$ – $\frac{1}{8}$ in.); Oligoclase, pale-green, crystals, size of last; Mica, blackish-green, in spots.

Of the preceding analyses, Nos. 2, 3, 4, and 5, by Delesse, are useless in the present inquiry, as they contain no estimate of the magnesia, and they are also, in other respects, very deficient; the quantity of magnesia found in Nos. 1 and 6 is not sensibly greater than that always found in granites that never were supposed to contain Talc—a mineral that includes 33 per cent. of magnesia in its composition—but which do contain a dark-coloured Iron and Magnesia Mica. In fact, the granite of Mont Blanc is identical with that of the Leinster range, as is shown by the following comparison: —

	Mont Blanc.	Leinster Range.*
	Mean of 6 Analyses.	Mean of 11 Analyses.
Silica,	72·80	72·07
Alumina,	13·23	14·81
Iron (peroxide),	1·98	2·22
Iron (protoxide),	1·48	0·30
Manganese (protoxide),	0·40	
Lime,	1·34	1·63
Magnesia,	0·62	0·33
Potash,	3·62	5·11
Soda,	3·69	2·79
Water,	0·76	1·09
	99·92	100·05

* Trans. Royal Irish Academy, vol. xxiii., p. 599 (Science).

I have dwelt on this subject at greater length, perhaps, than its importance deserves; but I was anxious to establish the serious danger of neglecting the geological canon—"Not to assume in a rock the existence of a mineral, unless its presence is established by distinct analysis."

The neglect of this canon has led, as we have seen, to the invention of Protogene, which has no existence except in the imagination of its authors; and yet the definition of this phantom-rock appears from year to year in the most approved text-books of English geologists.

It must not, however, be forgotten, that in the opinion of M. Brochant de Villiers,* one of the highest authorities on this question, no true granite is to be found in the chain of the high Alps, which, according to him, are composed altogether of talcose schists, talcose limestone, serpentines, and talcose felspathic schists; while the true granites of the Alps are to be sought in the low ground to the south of the Alps, at Biella, Crevacore, La Sesia, Baveno, and other places. The conclusions of M. Brochant de Villiers' remarkable Memoir are summed up as follows :—

"1st. That the granitic rocks of Mont Blanc, and others resembling them of the high summits of the Alps (from the Mont Cenis to St. Gothard), are not granites, and that consequently there does not appear to be any true granite in these high crests.

"2nd. That these granitic rocks are but extreme varieties (more crystalline and more abounding in felspar) of a talcose felspathic rock, much more abundant in the Alps, and with which it is found united.

"3rd. That this talcose rock, also associated with other talcose rocks, constitutes a peculiar formation, predominant in a great part of the Alps.

"4th. That ores of metals almost always occur as beds in this formation.

"5th. That a true granitic formation exists in the Alps on the southern edge of the chain, which, from analogies founded on all the facts now received in geology, contributes, with all the preceding characters, to establish the little relative antiquity of the supposed granites of Mont Blanc and the high Alps, as well as that of the talcose rocks, of which it forms a part."

While I readily admit that talc is to be found in abundance in the metamorphic rocks of the Alps, I believe M. Brochant to be in error, when he denies the existence of true granite, in a narrow band, running along the summits of the high Alps.

The following analysis of a specimen of talc, from the granitoid schists of the neighbourhood of the Handeck Falls, in the Grimsel Pass, and associated with a pale-green Oligoclase—given to me by Mr. Robert S. Reeves—shows the character of the Swiss talc, and, at the same

* Annales des Mines, 1819.

time, demonstrates its non-existence as a constituent of the so-called Protogene of Mont Blanc.

Talc from near Handeck.

	Per-centage.	Oxygen.	Atoms.
Silica,	61·20	31·77	5
Alumina,	0·60		
Iron (peroxide),	2·38		
Lime,	0·23	0·06	
Magnesia,	30·80	12·31	
Soda,	0·06	0·01 } 12·59	2
Potash,	0·11	0·01	
Iron (protoxide),	0·92	0·20	
Water,	1·20	1·07	
	97·50		

The truth appears to be, that geologists who have sought for the eruptive characters of granite in the Alps have been surprised to find what appeared to them only a highly inclined metamorphic felspathic schist, flanked by micaceous talcose and calcareous rocks, to which the eruptive character could not with propriety be attributed. This difficulty, however, disappears as soon as we abandon our preconceived notion of how granite ought to present itself. In Donegal, for example, we find true granite, which, in its structure and bedding, is identical with the beds of limestone, felspathic schist, and mica slate, with which it is *interstratified*, flanked, as in the Alps, with steatitic beds of talcose slate, and having mineral lodes occupying the planes of its laminated structure.

In Sweden and Norway, also, the granite beds pass by insensible gradations into the adjacent gneiss, felspathic, and micaceous schists, and contain, as in the Alps and Ireland, mineral lodes running along its planes of bedding.

Both in Norway and Donegal, oligoclase, as well as orthoclase, abounds in the granite; and these two felspars are also found in the Protogene of Mont Blanc.

Let us suppose that the constituent minerals of an igneous rock have been carefully and conscientiously determined by the separate chemical examination of each, and that we wish to learn the per-centage of each mineral that the whole rock contains.

The first and most obvious method of determining this per-centage, viz. by specific gravities, unfortunately only applies to mixtures of two minerals; for the problem of mixtures, solved by Archimedes, only

furnishes two equations, and can therefore only determine two unknown quantities.*

Delesse has attempted to remedy this fatal imperfection of Archimedes' method by the direct measurement of the volumes of the constituents of the rock. He measures, very ingeniously, the surfaces of each constituent exposed in the polished face of the rock, and having assumed the plane surfaces to be proportional to the volumes of the minerals present, he determines the per-centage by weight.†

Some years ago I published, in the Journal of the Geological Society of London, and afterwards more fully in the Transactions of the Royal Irish Academy, a method of finding with precision, by chemical analysis, the per-centages of constituent minerals when they are not more than three in number. This method, therefore, has the advantage of Archimedes' method by one additional equation, and though it does not apply to mixtures as complicated as those discussed by Delesse, it has greatly the advantage of his method in accuracy, and is more easy of application.

With respect to the igneous or aqueous origin of granite, Geologists in recent times have almost unanimously advocated the igneous theory, and Chemists the aqueous theory.

The evidence of the Geologists has been collected in the field, and though it is wanting in the scientific precision which the Chemists have called to their aid, yet it possesses a force which all the arguments on the other side have, as yet, failed to oppose. The evidence in favour of the igneous origin of granite is essentially physical, and founded on the observation, in the field, of the manner in which granite is found to penetrate, in minute veins, every rock older than itself with which it comes in contact. It appears to me that no pasty condition of granite, such as that imagined by our distinguished honorary member Delesse, and that no aqueous solution of granite, can account for the remarkable group of physical facts which geologists have collected on this subject since the days of Hutton; and that we must admit that when granite penetrated the schists and limestones beside it, in small veins, it must have had a

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* Let A, B, C, &c., denote the absolute weights of the constituent minerals, and a, b, c, &c., the corresponding specific weights; while W and w are the weight of the whole specimen and its specific gravity; the equations are

$$A + B + C + \&c. = W. \tag{1}$$

and

$$\frac{A}{a} + \frac{B}{b} + \frac{C}{c} + \&c. = \frac{W}{w}. \tag{2}$$

† Let p, p', p'', &c., denote the measured surfaces, and d, d', d'', be the specific gravities of the constituent minerals, while P, D, denote the whole polished surface and specific gravity of the rock; Delesse asserts

$$pd + p'd' + \&c. = PD, \tag{1}$$

and so obtains the means of calculating the per-centages by weight.

liquidity greater, perhaps, than that of any lava with which we are acquainted, except, probably, the siliceous lava of the Sandwich Islands. On the other hand, the arguments derived from chemistry appear to me equally unanswerable, in showing that water was present in abundance during the formation of granite, and that in some cases it is even to be regarded almost in the light of a chemical precipitate from an aqueous solution.

Before attempting to reconcile these opposite views, let us consider for a moment the arguments of the Chemists. They are as follow:—

I. The specific gravity of the quartz that occurs in granite is known to be 2·6, which Count Schaffgotsch has proved to be the specific gravity of silica formed by aqueous solution; while the specific gravity of silica which has undergone igneous fusion is only 2·2.

II. Fuchs has shown that in granite we have several minerals—quartz, feldspar, mica—whose points of fusion are very different; and yet they have not crystallized in the order of their infusibility, but in the inverse order, viz. of their fusibility; the most infusible of them all, quartz, having crystallized last, and acted the part of a mother-liquor to the others.

III. Professor Heinrich Rose observes that the presence of such minerals in granite as Oligoclase, the Micas, Hornblende, &c., in presence of free silica, is inconsistent with the hypothesis of igneous fusion; as such fusion would convert these minerals into more highly silicated forms.

IV. Lastly, the actual presence of large quantities of water (4 per cent.) in margarodite mica, which forms an important constituent of the granites of Leinster and Donegal; and the occurrence of such minerals as Allanite, Gadolinite, &c., in the Norway granites, minerals which intumesce and change their properties on ignition; the presence of such minerals as these in granite appears to many chemists inconsistent with the theory of igneous fusion.

Of these arguments, I confess that the first and fourth alone appear to me to be conclusive; and that the force of the second and third may be evaded by an appeal to our ignorance of the manner in which "liquation" may operate in determining the order and manner of crystallization of minerals forming on the cooling of a mixed magma, after igneous fusion. Indeed, with respect to the second argument, which requires quartz to crystallize first in granite, I am only acquainted with two rocks in which this condition has been fulfilled, by the separation of the quartz in the form of double hexagonal pyramids. These two rocks are—the feldspar porphyry of Forkhill, in the county of Armagh, and the granite of Slieve Corragh, in the county of Down. The porphyry of Forkhill would be pronounced by any geologist to be a metamorphic slate, and not a fused rock, and yet it fulfils Fuchs' condition of igneous fusion, by the apparent order of crystallization of its constituent minerals.

The following analysis shows the composition of the Forkhill porphyry :—

Forkhill Porphyry.

	Per-centage.
Silica, ...	76·00
Alumina, ...	8·72
Iron (peroxide), ...	5·33
Lime, ...	0·79
Magnesia, ...	0·11
Soda, ...	0·88
Potash, ...	7·82
Iron (protoxide), ...	0·15
Manganese (protoxide), ...	0·20
Water, ...	0·40
	100·40

Physical description of Forkhill Porphyry.

A felspathic quartziferous porphyry. Sp. gr. = 2·588.

Paste, greyish, or honey-yellow, of felstone texture, dull lustre.

Quartz crystals very perfect ($\frac{1}{8}$ in.), studded abundantly through the paste in six-sided pyramids and prisms.

Rare black specks, like hornblende, sometimes segregating themselves into lenticular masses.

The argument against the igneous origin of granite derived from the specific gravity of its quartz, appears to deserve much attention, from the fact, that the difference of density observable in bodies crystallizing from aqueous and igneous fusion (the former exceeding the latter) appears to be universal, and attributable to the retention of latent heat by the substance exposed to igneous fusion.

Thus sulphur, as is well known, crystallized from its solution in chloride of sulphur or bisulphuret of carbon, has a specific gravity of 2·05; while the crystals formed from melted sulphur have only a specific gravity of 1·98; and the third variety of sulphur, known as Ductile Sulphur, formed at a still higher temperature, has a still less specific gravity, being only 1·957.

But we need not have recourse to the analogies of chemistry to show the diminution in specific gravity which granite or quartz would undergo if fused.

M. Delesse has published* experiments on the specific gravity of various rocks in their natural and artificial fused or vitreous condition, from which I have calculated the following table:—

* Liebig and Kopp, Annual Reports, vol. ii. p. 457. 1847-8.

Table of Specific Gravities of Natural and Artificially Fused Rocks.

Name of Rock.	Specific Gravity of Natural Rock.	Specific Gravity of the Glass.	Difference.	Number of Specimens.
Euphotide, . . .	2·9647	2·5310	0·4337	3
Granite, Quartz-porphyry,	2·6626	2·3913	0·2713	8
Porphyry, ...	2·6872	2·4400	0·2472	5
Granite Porphyry, . .	2·6510	2·4250	0·2260	1
Syenitic Granite, . . .	2·6677	2·4500	0·2177	3
Diorite, ...	2·8593	2·6570	0·2023	3
Melaphyre, ...	2·7750	2·6040	0·1710	1
Trachyte, ...	2·7270	2·6170	0·1100	1
Basalt, ...	2·8524	2·7700	0·0824	5
Modern Lava, . . .	2·5233	2·4919	0·0314	8

It appears to me that the column of differences in the preceding table greatly strengthens the argument of those chemists and geologists who believe that water played a much more important part in the formation of granites and traps than it has done in the production of Trachytes, Basalts, and Lavas, and that they owe their relatively high specific gravity to its agency.

The only manner in which it seems possible to reconcile the opposite theories of the origin of granite, derived from physical and chemical arguments, is to admit for granite what may be called a Hydrometamorphic origin, which is the converse of what is commonly called metamorphic action, but which might more properly be designated as Pyrometamorphic action. The metamorphism of rocks might thus be assumed to be twofold: Hydrometamorphism, by which rocks, originally fused, and when in liquid fusion, poured into veins and dykes in pre-existing rocks, are subsequently altered in specific gravity and arrangement of minerals, by the action of water acting at temperatures which, though still high, would be quite inadequate to fuse the rock; and Pyrometamorphism, by which rocks originally stratified by mechanical deposition from water come to be subsequently acted on by heat, and so transformed into what are commonly called the metamorphic rocks.

Granite, it appears to me, although generally a Hydrometamorphic rock, may occasionally be the result of Pyrometamorphic action; and such appears to have been its origin in Donegal, in Norway, and, perhaps, in the chain of the Swiss Alps.

MINUTES OF PROCEEDINGS OF THE YEAR 1861-62.

GENERAL MEETING, MARCH 13, 1861.

THE PRESIDENT in the Chair.

Minutes of last meeting were read and confirmed, donations announced, and thanks voted.

The following gentlemen were elected members of the Society:—Charles H. Johnston, Esq., 9, Eustace-street; W. Lewis, C. E., 13, Nelson-street; Alfred Hudson, M. D., 2, Merrion-square, N.; Charles S. Whitney, Esq., Merton, Roscarbery, Cork; E. H. Blake, Esq., Farmers' Club, Sackville-street.

R. Mallet, Esq., F. R. S., then read his paper, entitled "A Sketch of the Physical Features of Southern Italy, and of the results of the Earthquake Exploration of 1857."

Dr. Davis made some remarks.

The discussion on Mr. Mallet's paper was adjourned to April 10.

The meeting then adjourned.

GENERAL MEETING, APRIL 10, 1861.

THE PRESIDENT in the Chair.

Minutes of last meeting were read and confirmed, donations announced, and thanks voted.

The following gentlemen were elected Members of the Society:—Thomas Hone, Esq., Yapton, Monkstown; and Sir D. J. Dickinson, 10, Mountjoy-place.

A collection of minerals was presented by L. Fleming, C. E., being the remains of the collection of the late R. Townsend, C. E., formerly a member of the Society.

Mr. Mallet presented a collection of Vesuvian minerals and rocks, and a specimen of a metallic substance, stated to be from Coollatin, Co. Wicklow. The thanks of the Society were unanimously voted.

Mr. Mallet gave a brief account of his paper read on last evening.

The President and Dr. Davis made some remarks.

The revised By-Laws were laid before the Society.

The meeting then adjourned.

GENERAL MEETING, MAY 8, 1861.

THE PRESIDENT in the Chair.

Minutes of last meeting were read and confirmed, donations announced, and thanks voted.

Mr. R. H. Scott read his paper, entitled "Notes on the Method of Copper-smelting practised at Oker, in the Unter-Hartz, and on the Geology of the Neighbourhood."

He also communicated the Analysis of a specimen from Croghan Kinshela, presented by Mr. Mallet at the last meeting, which he found to be Metallic Bismuth.

The President read his paper "On a Magnesian Limestone Horizon at the base of the Coal-measures in various localities in Ireland, and on the Anthracite Horizon in the Silurian Slates of the North of Ireland."

Mr. Jukes, M. Gages, Mr. Kelly, and Mr. Ganly made some remarks.

The President laid a letter from Mr. Du Noyer, relative to the explanation of Sheets 102 and 112 of the Geological Map of the county of Dublin, before the Society.

The revised By-Laws were submitted for the second time to the Society, and passed.

The meeting then adjourned.

GENERAL MEETING, JUNE 12, 1861.

THE PRESIDENT in the Chair.

Minutes of last meeting were read and confirmed, donations announced, and thanks voted.

A specimen of Felspar, containing some very large crystals of Tourmaline, from the Three-rock Mountain, was presented by W. B. Brownrigg, Esq.

Also some specimens containing Beryls, &c., from Kingstown, were presented to the Society by Mr. H. E. Bolton.

Mr. Scott announced that it appeared, on further inquiries, that the specimen of Bismuth, of which he communicated the analysis at the last meeting, was not from Croghan Kinshela, as stated by Mr. Suter.

Mr. Bateman read the paper, written by him and Messrs. Barton and Dopping, "On the Chair of Kildare."

The President read the following letter from Mr. Mallet, relative to the experiments of MM. Jamin and Daubrée, "On the Resistance offered by Moisture to the passage of Gases and Liquids through porous materials:"—

"1, *Grosvenor Terrace, Monkstown, Co. Dublin,*
"*June* 9, 1861.

"MY DEAR SIR,—In the current number of the 'Philosophical Magazine' I observe, translated from the 'Comptes Rendus' for 28th January last, a paper by M. Daubrée, in which that geologist draws several deductions of high importance as respects the theory of volcanic action, from the experiments of M. Jamin upon the properties of porous bodies in permitting the passage of liquids, and preventing that of gases or vapours, the former passing even against considerable pressures of the latter.

"A translation of M. Jamin's paper appeared in the 'Philosophical Magazine,' vol. xix., p. 204,—the original paper having appeared, if I recollect right, also in the 'Comptes Rendus.'

"The object of my present communication is to ask you to recall a conversation we had at your rooms, Museum Building, Trinity College, early last summer; in which, conversing on the subject of volcanic action, I referred to M. Jamin's results as to the action of porous bodies, and to Gay Lussac's remarkable paper on the theory of volcanic action, published many years ago in the 'Annales de Chimie,' in which the latter starts the difficulty of how water finds its way to the volcanic foci, without being forced back by a tension of vapour below that is capable of sustaining columns of thousands of feet in height of lava. I upon that occasion described to you Jamin's results, and stated how I considered they bore directly upon the volcanic question; and explained to you, pretty nearly in the words of Mr. Daubrée's article, above referred to, how, as it appeared to me, they solved the difficulty; and indicated the process by which a constant supply of water was afforded to the volcanic foci, illustrating my remarks by appeal to the porous limestone of Southern Italy, &c.

"I am, dear Sir, truly yours,

"R. MALLET.

"*Professor Haughton*, 17, *Heytesbury Terrace*."

The President read his paper "On the Occurrence of Oligoclase in the Gneissose Granite of Castle-Caldwell, Co. Fermanagh."

Mr. Jukes read his paper, entitled "Notes on some Points in the Geology of the Co. Antrim."

The meeting then adjourned.

General Meeting, November 13, 1861.

The President in the Chair.

The Minutes of the last meeting having been read and confirmed, the Secretary announced the donation of a large number of works, consisting chiefly of the transactions of scientific societies, and thanks were voted to the donors.

The following gentlemen were elected Members of the Society:—John Connolly, Kilmore, Artane; Benjamin T. Patterson, 206, Great Brunswick-street; Dr. Busteed, Castlegregory, Tralee (non-resident Life Member); H. E. Bolton, Fitzwilliam Lodge, Blackrock; H. T. Humphreys, Woodview, Merrion-avenue; Rev. G. W. Dalton, 66, Upper Leeson-street.

The following gentlemen were also elected as Associate Members for the year 1861–62:—John Dickinson, 10, Mountjoy-place; E. S. Quinton, 33, Leinster-road; G. Barnardo, Dame-street; G. Russell, Glenageary-hill, Kingstown; Thomas Livesey, 16, Ranelagh-road; C. W. Bateman, Camden-street; R. L. Jones, Drumnigh; H. Shillington, 17, Grantham-street; William Doyle, Martello-terrace, Sandymount; J. M. Scott, Trinity College.

Mr. Scott then read a paper "On the Granitic Rocks of Donegal, and the Minerals associated with them" (p. 285).

Mr. Blake also read a paper "On the Primary Rocks of Donegal" (p. 294).

The President said that though he did not quite agree with Mr. Blake's views relative to the impossibility of the horizontal deposition of the primary rocks, he most fully acquiesced in the accuracy of Mr. Blake's observations of the directions of the joints, &c., and therefore he regretted that Mr. Blake should have departed from the region of facts, and gone into theory. After offering some remarks derived from his own observations in confirmation of Mr. Scott's paper, the President, in conclusion, said that some of the specimens of beryl granite resembled specimens which had been given to him many years ago by Dr. Croker, which had been found in South Australia.

Professor Jukes said he was glad to see that geologists were beginning to examine the mineralogical construction of rocks. He was disposed to think that there might be two origins of granite.

Dr. Sidney said that, for the valuable results which had been attained in the papers just read they were, to a considerable extent, indebted to the kind facilities afforded by Mr. Harte, the County Surveyor of the Western District of Donegal, who was in the highest degree entitled to their thanks. It would not, therefore, be right to separate without passing such a vote, in which Mr. Blake should be included, were it not that he was a member of the Society. The papers were amongst the most important that ever came before them.

Professor Jukes seconded the motion, which passed unanimously.

The meeting then separated.

General Meeting, December 11, 1861.

The President in the Chair.

The Minutes of the last Meeting were read and confirmed; and the following gentlemen were elected Associates for the year 1861–2:—

W. Knapp, Esq., 6, Belgrave-square; W. C. Owen, Esq., 30, Trinity College; E. Heath, Esq., 2, Synnot-place; James S. Glenny, Esq., 25, Upper Gloucester-street.

The President laid on the table a donation of so-called "Worm-tracks," being a remarkable addition to the fossils of the Queen's County, presented by the Rev. Mr. Emerson.

Thanks were voted to the donor.

Mr. Robert H. Scott, M. A., one of the Honorary Secretaries, read a paper by Professor H. B. Geinitz, of Dresden, an honorary member of the society, "On the *Cervus* (Megaceros) *Hibernicus*, from the county of Limerick, in the Royal Museum at Dresden."

"Every one who has seen the magnificent skeletons of the great Irish elk, in the Museums of London and Dublin, will look upon them as the greatest ornaments which a Geological collection can possess. I happened last year fortunately to obtain, through the kindness of Mr. W. H. Baily, F. G. S., the able palæontologist to the Geological Survey of Ireland, a nearly complete skeleton of this extinct animal. The specimen was found in a bog in the county of Limerick, by Mr. W. Hinchy, of Limerick. Having bought the specimen on Mr. Baily's recommendation, without having myself seen it, I am desirous of placing on record my satisfaction at the way in which Mr. Hinchy has answered the expectations I had been led to form of him.

Dr. Voigtländer, of Dresden, has put the skeleton together and compared it with the living "*Cervus alces*," or elk. I subjoin the relative dimensions in centimetres:—

	Megaceros.	Cervus Alces.
Height of skeleton,	184·0	168·0
Length ,,	269·0	226·6
Length of head,	49·0	54·3
Breadth of forehead from upper margin of *orbita* to same part of other side,	28·4	22·5
Length from *orbita* to *os intermaxillare*,	28·4	36·0
Length from point of *ossa nasi* to the anterior portion of the *os intermaxillare*,	12·5	26·0
Length from the *foramen magnum* to the *linea semicircularis superior ossis occipitis*,	11·8	9·5
Length from posterior part of the *os palatinum* to the anterior margin of the *os intermaxillare*,	27·8	35·4
Length of *scapula*,	49·0	37·8
,, *humerus*,	37·8	37·8
,, *ulna*,	37·8	42·6
,, *ossa carpi*,	6·0	5·3
,, *metacarpus*,	33·1	35·4
,, *femur*,	44·9	44·9
,, *tibia*,	44·9	46·0
,, *ossa tarsi*,	20·0	17·8
,, *metatarsus*,	35·4	42·0
,, *first phalanx*,	7·7	8·3
,, *second phalanx*,	4·7	5·3
,, *third phalanx*,	7·1	8·9

"The span distance of the antlers measured over the forehead is 3.824 metres, or 12 feet 6 inches.

"The interest of the specimen is increased by some pathological alterations of bones, of which Professor D. Zeis, of Dresden, gives the following description :—The lower half of the metacarpus of the right leg is, in the extension of from 7 to 9.5 centims., one centim. thicker than the corresponding part of the other leg, swelling up equally, and gradually tapering. Some osteophytes are only to be observed at the place where the *Ligamenta capsularia* are inserted. A greater alteration is observable in the left lower jaw. This bone is partially destroyed by external influence, so that the teeth for a distance of about 6 centim. are wanting. Both ends of the bone, close to this gap, are driven up and loosened. It seems to me that the partial destruction of the lower jaw may have taken place just at this point, because here the bone has lost its primitive solidity. However,

although this defect exists, the circumference of this lower jaw immediately before the first tooth is still 2 centim. more than that of the corresponding part of the lower jaw on the right side."

The President said it would be most convenient for him to read his paper "On the Discovery of an Irish Elk, with a notice of allusions to this animal in the Book of Lismore," and then to take the discussion jointly upon it and the preceding paper. In the summer of 1859 the remains of an elk had been found between Slatey and Hollymount, in the Queen's County. He had an opportunity of visiting the locality immediately after the discovery of the fossil bones, and had secured the skeleton for the Museum of the Royal Dublin Society, in whose collection it was now deposited, and he hoped it would shortly be exhibited to the public. The skeleton was found doubled up in a layer of calcareous marl, about two feet deep, under a superficial covering of peaty earth, not more than one foot in thickness; and it would be as difficult to convince him that the fossil deer that owned these bones lived countless ages ago, as it would be to prove that the skeleton of a cat dug up in a garden, or the bone of a sheep buried by a dog, had been deposited in the ground before the creation of man. Whatever evidence there was upon the subject seemed to him to tend altogether in the opposite direction; and he availed himself of the present opportunity of bringing forward a remarkable passage, bearing on the history of the Irish deer, which had been furnished to him by Mr. Eugene O'Curry, Professor of Irish Literature in the Catholic University of Ireland. Although the passage contained traces of the poetical exaggeration natural to the Celtic mind, there was nothing in it that detracted from its value as a document, proving the existence of the Irish fossil deer, at a period shortly antecedent to the preaching of St. Patrick in this island. The following communication from Professor O'Curry contained the passage alluded to from the "Book of Lismore." The first part of the communication consisted of a brief explanation, prefixed by Professor O'Curry:—

"Caielte Mac Ronan had been one of Finn Mac Coole's chosen officers. This Caeilte, with Disin, the celebrated son of Finn, and a few others, are said to have long survived their cotemporaries, and lived down to the time of St. Patrick, to whom, as well as to others, they related much of their renowned chief's life and adventures. One time that Caeilte was sojourning in Ulster, he directed his steps to the lake of the Red Ox (Loch Daimh Deirg), situated near Moira, in the county of Down. Here he visited two of St. Patrick's disciples, namely, Colman Ela and Eogan, who appear to have had a church upon an island in the lake. Here Caeilte was well received and entertained." And the story goes on to say (translation)—"After they had dined, Colman asked Caeilte why the name of Lake of the Red Ox had been given to this lake. Caeilte answered him, and said, 'A red (wild) ox, roved the dripping slopes of the Luachra (the great rushy district on the borders of Kerry and Cork), in the south; and he used to escape from the men and the hounds of the Fians in the three attacks made on him every year, until at last the Fians followed him to this place. Four of us, of the Fenian party, overtook him here, namely, Dermot O'Duoney, and Mac Lugagh, and Mac Enkerdo, of Beare, (and myself); and I happened to be the nearest to him at coming to this ford; and we threw our spears at him together, and he fell by us; and I took one of his antlers, and Dermot took the other antler with him to Finn, at Temar Luachra (in the south). And when Finn laid the butt of the horn at his foot, the upper tine of it reached above his head, though he (Finn) was the tallest man of the Fians. And I left the other horn at the head of this island; and if I had daylight, it is probable that I could find it.'.... Caeilte went then to the western nook of the island, and he thrust his hand down into the brink, and brought up the horn, and laid it on the floor of the house in which the clerics were. He who was king of Ulidia at this time was Eochaid Derg, son of Ferglinne, and he was encamped convenient to them, at Tulli-na-narm (Hill of the Spears), which is also called Moira. And Colman Ela and Eogan arose early the next day, and in a company of six churchmen they took the horn with them to show it to the king of Ulidia and the Ulidians. Two hundred armed men was their number there. The churchmen placed the horn before the king, and it was found that they would all find shelter from foul weather and tempest under its shade."

The President further said that the soil, over the marl, where the remains of which he now spoke were found, was exceedingly marshy, and very little different, he thought, from what it must have been when the elk died there. The remains had the appearance of being quite modern. The people who found them had a most exaggerated idea of their value, but at last assented to his terms. With respect to the concluding sentence of the translated passages from the Book of Lismore, he considered that it was to be understood as meaning—not, of course, that the antler would shelter two hundred persons, but that the biggest man of the party might have taken shelter under it.

Dr. Petrie asked what was the general opinion of scientific men as to the question of the antiquity of these remains.

President.—Doctors differ. Some believe that the elk existed long before the creation of man, others believe that the ancient Irish killed and eat him. The best evidences in favour of that view were contained in a pamphlet written by Dr. Harte, and also the work by Gosse, "The Romance of Natural History," and the writings of Richardson. The only evidence on the other side was of a negative character. The only alleged case of human remains being found with elks' bones had turned out to be a mistake. Elks' bones were found in great abundance in France.

Professor Jukes.—As far as the base of the Pyrenees.

Dr. Petrie stated that when he was a young man, a gentleman, a friend of his, purchased a property in the county of Meath. In a bog on that property, under which was marl, were found very many skeletons of elks. Along with the bones was found an old iron sword, which his friend gave him, and he had it at present. It had a bone handle, and was of later date than the bronze swords. On some of the horns and heads of elks found there, he was shown cuts. Pausanias, a Greek writer of the second century, writing on the question as to whether the tusk of the elephant should be regarded as a tooth or a horn, referred in proof of his argument to the "Celtic Elk"—

"Such as are of opinion that the prominences from the mouth of the elephant are teeth, and not horns, should look at the Celtic elk and the Æthiopian bulls: for the male elks have horns over their eyebrows, but the female have no horns; and the Æthiopian bulls have horns growing out of their nostrils."*

That by the term *Celtic*, Pausanias meant the country or countries of the Gauls, or Celtæ, is plain from many passages in his work, of which the following is an instance:—

"It is by no means, therefore, wonderful that the white poplar should grow first of all by the side of the River Acheron; and the black poplar on the banks of the Celtic Eridanus, and in the country of the Gauls."†

Mr. E. H. Blake said he saw a pair of elk's horns taken from a bog in Mayo, below which he believed there was no clay.

Dr. E. Perceval Wright stated that the Museum of Trinity College possessed a very fine series of the Irish elk, perhaps the finest in existence. In addition to two perfect male skeletons, and one female, there were eleven skulls of the male, and one of the female animal. The skeletons referred to possessed not only the rare phalangeal bones, but also perfect sets of incisor teeth. From an examination of more than thirty specimens of the heads and horns of the megaceros, Dr. Wright was of opinion that all the supposed sword cuts, &c., on the horns, were not the work of men contemporaries of the elk, but of the workmen engaged in raising them from the bogs.

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* Ὅσοι δὲ ἀνθρώπων τὰ διὰ τοῦ στόματος ἐς τὸ ἐκτὸς ἐλέφασιν ἐξίσχοντα ὀδόντας τῶν θηρίων εἶναι, καὶ οὐ κέρατα ἥγηνται, τούτοις ἐστὶν ἀπιδεῖν μὲν ἐς τὰς ἄλκας τὸ ἐν Κελτικῇ θηρίον, ἀπιδεῖν δὲ ἐς τους Αἰθιοπικοὺς ταύρους· ἄλκαι μὲν γὰρ καὶ κέρατα ἐπὶ ταῖς ὀφρύσιν ἔχουσιν οἱ ἄῤῥενες, τὸ δὲ θῆλυ οὐ φύει τοπαράπαν. Οἱ δὲ Αἰθιοπικοὶ ταῦροι τὰ κέρατα φύουσιν ἐπὶ τῇ ῥινί.—PAUSANIAS' Description of Greece, lib. v., cap. xii.

† Οὕτω καὶ τὴν λέυκην θαῦμα οὐδὲν, αἴγειρόν τε καὶ κότινον, τὴν μὲν ἐπὶ Ἀχέροντι ἀναφῦναι πρῶτον, κότινον δὲ ἐπὶ τῷ Ἀλφειῷ, τὴν δὲ αἴγειρον γῆς τῆς τῶν Κελτῶν καὶ Ἠριδανοῦ τοῦ Κελτικοῦ θρέμμα εἶναι.—*Ibid*, cap. xiv.

Professor Jukes mentioned a head of a megaceros seen by him, which had been taken from a bog, at the making of a railway cutting near Rathdrum. The drain was about eight feet deep. The head was deposited in a bog, and no clay was visible behind it. He supposed the time of the deposition to have been between the commencement of the bottom of the bog and the growth of the top. He believed the megaceros to have been contemporaneous with the mammoth. He did not know of its bones being associated with flint implements. The injuries apparent on the bones of elks may not have been received from man at all, but may have been bruises sustained by the animal while pushing its way through thickets or forests. Man and the megaceros may have been contemporaneous in other countries, and not in this, as man at the time might not have come so far west.

Mr. Baily mentioned an account by Professor Morlot, printed in the *Journal of the Geological Institute of Vienna*, of bones of elks associated with spear-heads and fragments of pottery, the whole having been found near a small lake, in the canton of Berne. Dr. Geinitz's specimen was found in a bog at Kilcullane, between Bruff and Limerick.

Dr. Wilde observed, that the first person who instituted a comparison between the remains of the *Cervus alces* and those of the Irish megaceros was Sir Thos. Molyneux, a distinguished Irish physician, anatomist, antiquarian, and geologist. Professor O'Curry informed him that the elk was not named at all in early Irish literature. He saw many years ago, in a museum on the Continent, a megaceros horn bearing on it an inscription, carved in letters of considerable size, which archæologists believed to be contemporaneous with the deposition of the horn. The language of that inscription was not known in Europe, and it was a great puzzle to philologists. This was found on the banks of the Danube, near some very interesting antiquarian remains.

Mr. Doyle mentioned three instances which he saw of remains of elks, found in this country. One was at Downpatrick, in 1834. In that case, the remains were found three or four feet deep, in a marly hollow—no bog. Another was a collection of five heads, with partially decayed horns, very soft, found in a bog, in the county Wicklow, at Leamore.

Dr. Stokes said he did not see what important geological question was to be solved by determining whether these remains were contemporaneous with man, or not. He could not comprehend what Dr. Wilde had said as to the want of notice of the elk in "early Celtic literature;" for he did not know what that literature was, or where it was. He never heard of "early Celtic literature." He doubted very much if we had any reliable Irish literature anterior to the eighth century. As to the notice in the Book of Lismore, it was to be expected that any notice of the elk there would be in a mythical form. Whether contemporaneous with man, or not, the megaceros would appear to be a very late animal. In truth, its remains were not fossils at all. He had, while a student, analyzed some of the bones, and found no fossilization—the earthy and animal ingredients being in the same proportions as if the animal had recently died. When Archdeacon Maunsell sent up a skeleton to the Royal Dublin Society, he remembered that in his letter accompanying it was a statement, that he had found marrow in the bones, which proved to be combustible, and actually burned when ignited. The same letter stated that along with that skeleton were found some ancient Irish jet rings. He believed that, if the megaceros were not contemporaneous with man, it was nearer to him than any other extinct animal that we know of.

Professor R. W. Smith said he had in his possession a considerable collection of specimens of bones of the animal in question; and some of these, which were bones of the feet, exhibited evidences of a form of disease which in man only occurred at a very advanced period of life. This disease was alluded to in Dr. Geinitz's paper, as noticed by Dr. Zeis. The question as to the probable duration of life of the elk, so far as it could be inferred from evidence of that kind, was an interesting one.

The President expressed his regret that Dr. Geinitz was not amongst them, to wind up the discussion with a reply. He had to express his satisfaction that they had succeeded in bringing amongst them a body of gentlemen whose researches lay in a direction different from theirs, while they were equally valuable and important; and who, although they were antiquarians, must admit that the geologists cultivated an antiquity older than theirs. They welcomed amongst them and rejoiced at hearing the opinions of

the erudite scholar (Dr. Petrie), who might be called the father of Irish antiquities. With regard to the quotation from Pausanias, the question under discussion had attracted the attention of so many learned men, that it was difficult, after all, to say what passage of any writer of antiquity had, and what had not, been brought forward as bearing upon it. The present question, though of real importance, had yet a factitious importance attached to it. Geologists, and also all other antiquarians, appeared to him to have a tendency to exaggerate the antiquity of the remains with which they were concerned. Dr. Petrie's work on the Irish Round Towers had dispelled the exaggerated notions of their extreme antiquity, and had shown that they were not Druidical or Pagan. On the present question he had always leant to the opinion of Dr. Harte. The date of the Book of Lismore was posterior to the introduction of Christianity in Ireland; and the other evidences which had been submitted went to show that the evidence against the contemporaneity of the remains with man was not so conclusive as had once been supposed. The name of Sir Thomas Molyneux was identified with Trinity College; he discovered bones both of the Irish elk and the Irish elephant, and sent them to the Royal Society of London— an example worthy of not being followed; and he trusted that in future antiquarian remains found in this country would be handed over to the care of the scientific bodies here, who well knew how to take care of them. When Professor O'Curry told him that the Irish name for the elk was, "Ox of the Deluge," he was certainly staggered in his belief that the animal was contemporaneous with man; because the Celtic mind was peculiarly observant of natural objects, and, as proved by the topographical names throughout the country, gave them highly poetic and appropriate names; and that consideration went to show that the name "Ox of the Deluge" must have had reference to a pre-historic animal. In the specimens lately presented by Dr. Wilde, he found crystals of blue phosphate of iron, such as might be found in the soil of a knacker's yard. The evidence, though conflicting, on the question before them, was highly interesting. He trusted that Dr. Smith would, on a future occasion, bring before them the question as to what the traces of injury or disease in these remains amounted to. Mr. Andrews, the President of the Natural History Society, had asked him to express his regret at not being able to attend, as he had some important matters to bring forward.

The meeting was then adjourned.

General Meeting, January 8, 1862.

The President in the Chair.

Minutes of last meeting read and confirmed, donations announced, and thanks voted.

Andrew Armstrong, Esq., Claddagh, Bray, was elected a Member; W. Harte, Esq., C. E., Donegal, a Non-resident Life Member; and J. Jameson, Esq., an Associate Member for the Session 1861–2.

Mr. R. H. Scott (Hon. Sec.) read the following letter from the Rev. R.V. Dixon, "On the Occurrence of an Ancient Paved Road under deep bog, in the neighbourhood of Omagh, County of Tyrone:"—

"*Clogherny, Dungannon, April* 11, 1861.

"Dear Sir,—I do not know whether you remember that Omagh is situated at the confluence of two rivers, which have filled the whole of the small plain in which they meet with an alluvial deposit of sandy loam, to the average depth of about three feet. These rivers now run in well-defined channels, some three or four feet at least below the level of the alluvial plain. Mr. Greer, my agent, was sinking a foundation for some houses he is about to build in the angle formed by the junction of the rivers. Having sunk through the alluvial loam, he came on a paved road or causeway, resting on the subjacent gravel, about nine feet wide, which is formed of rounded stones, of tolerably uniform size, closely laid together, and of such thickness as to form a stratum in a single course about eight or ten inches deep. I have written to him to have accurate measures taken of all these particulars, and to get the position and direction of the road accurately laid

down on the Ordnance Map. The road tends to a point in one of the rivers (the Camowen), which would form an excellent ford, where the water is shallow, and the bottom rocky,—perhaps it led to it when the ground between the rivers was a marsh, and such a paved causeway necessary for traffic. As a depth of three feet of alluvium has been deposited on it, it must be very old. I send a tracing from the revised Ordnance Survey, marking the position and direction of the road from memory. If the thing interests you, I will get you any further information you desire.

"Yours sincerely,

"ROBERT V. DIXON.

"*Rev. Professor Haughton, President Geological Society.*"

Mr. Scott read the following letter from C. W. Palliser, Esq., addressed to W. MacDougall, Esq., on a submarine bog recently discovered in Wexford Habour.

"*Wexford, Sept.* 22, 1861.

"MY DEAR SIR,—I think you may be interested in the following facts:—In sinking last June for foundations for the new engine-house, on the north side, at a place upwards of 900 yards from the nearest land,—that is from the former high-water mark,—after going through fourteen feet of blue mud, we came upon turf containing bog-oak and deal in considerable quantity. After passing through about six feet of this, we found mud again, of a greyish colour, two feet in depth, and then we came on solid marl, on which we built our foundations. I send you specimens of the blue mud, turf, and wood found in it. The pieces of wood I send are apparently the roots; all the larger pieces have been taken away, and used for firing. I cannot at present send you a specimen of the marl, as the excavation about the building has been all filled up; but when sinking for other portions of the work still to be done, I shall send you a bit of it. Before the land was reclaimed, the tide at high-water rose about five feet on the spot I allude to.

"Faithfully yours,

"C. W. PALLISER.

"*W. MacDougall, Esq.*"

The President stated that several sub-marine bogs were found at Belmullet and Achill Sound, in Mayo, and at several points along the coasts of Cork and Waterford. Mr. Palliser's account was the first which he had met with of the occurrence of the phenomena on the south-east coast.

The occurrence of similar bogs at Errislannon, county of Galway, was mentioned by Dr. Davis; at Courtmasherry, county of Cork, by Mr. Goode; at Belfast, by Mr. Jukes; at Killybegs, county of Donegal, by Mr. Scott; at Portrush, by Mr. M'Causland; and at Ballinoulart, Cahore Point, by Mr. Bolton.

Mr. Jukes said that he had seen the bogs alluded to at several points in Ireland, and also off New Brighton, near Liverpool, where, in the year 1837, he had found living pholades in the trunks of trees of which the bogs are composed.

The Secretary read a letter from John Locke, Esq., "On the Occurrence of Flint Implements in the Drift."

Mr. W. H. Baily, F. G. S., read his paper "On Graptolites and a Theca from Lower Silurian Rocks, in the counties of Meath, Tipperary, and Clare" (p. 300).

The President read the following letter from the Rev. John Storrs, relative to the Gold Fields of Nova Scotia:—

"*The Rectory, Cornwallis, Nova Scotia,*
"*B. N. America, Nov.* 27, 1861.

"DEAR SIR,—The gold fields of Nova Scotia appear in some degree to attract the attention of the home press. Several times I have thought of addressing you,—not to describe them, for scientifically I should fail,—and I have been led to believe that your knowledge of the geology of these parts has brought you in some measure acquainted with their nature and extent. Dawson (now President of M'Gill College, Canada) is the best Nova Scotian colonial authority as a geologist. Gesner, a native of this parish, though now residing in the United States, is not considered equal to President Dawson. So far as relates to the gold fields of Nova Scotia, I would merely state a few facts relative to the

light in which these auriferous regions are regarded by our natives and settlers. All individuals who have tried their luck—i. e. alone, or by twos or threes—have generally been glad to return to their ordinary labour, whether on the farm or in the woods, satisfied that remuneration was quite a lottery at the gold mines, with more blanks than prizes. In several instances companies have been formed by persons of means to take shares, so as to employ miners at stated wages. These companies have not all been successful, though I believe some of them have done more than pay wages; and one or two of the real business-men sold out their rights when the excitement was great, and in that way realised a profit. The population of this county—called King's County—exceeds 18,000. During the past summer and autumn, nearly all the men and youths visited one or other of the mines, intending to prosecute work as a real business, and nearly all returned after a few weeks' or months' absence, quite contented to resume the plough, the axe, or other implement of toil; and wages have not for eight years been so low, nor men so abundant. And yet I think there is gold in sufficient abundance to reward the miners. No doubt, the best method to be pursued is for responsible parties to form companies, and to hire labourers at stated wages. The Provincial Government thus invite the enterprising to come forward, and, no doubt, they think that that enterprise would be rewarded. Our winters might present obstacles which milder climates do not; and our autumnal rains are always very heavy, filling every pond or pool, and swelling every brook or stream into an angry current. The minerals of the province belong to the Crown, and not to the owners of the soil. Next year, no doubt, will test their value."

The meeting then adjourned.

Annual General Meeting, February 12, 1862.

The President in the Chair.

The ballot was declared open, the minutes of last meeting were read and confirmed, donations announced, and thanks voted.

Dr. Wilde presented a specimen of Itacolumite (flexible sandstone), from a locality twenty miles from Delhi, from Captain Warren, of the 27th Regt.

A stone found in a log of Dantzic timber, 16 inches square, was presented by Alderman Thomas Martin.

The following gentlemen were elected Members of the Society:—Edward Barrington, Esq., Fassaroe, Bray; and Ffolliott Barton, Esq., 2, Grattan-street.

Mr. Jukes, Honorary Secretary, read the Report of Council, List of Members gained and lost, and the statement of Accounts as certified by the auditors, R. Caldwell, Esq., and R. S. Reeves, Esq. (see p. 306).

Dr. Sidney and Mr. Scott were appointed by the President scrutineers of the ballot, which was declared closed, and the following gentlemen were elected Officers and Council for the year 1862-3 (see p. 319).

The President then read his Address.

Lord Talbot de Malahide proposed, and Mr. Caldwell seconded, that the President be requested to print his Address in the Journal of the Society (see p. 319).

The meeting then adjourned.

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D.

EXPLANATION OF PLATE IV.

(Illustrating Mr. BAILY's paper on Graptolites and other Fossils, page 300.)

LOWER SILURIAN GRAPTOLITES AND THECA.

Fig. 1. *a–c.—Didymograpsus Murchisoni* (Beck, sp.) Bellewstown, Co. Meath.

a, natural size; *b*, portion of the same enlarged 4 diameters, showing diagonal markings on the cells; *c*, compressed specimen, natural size.

Fig. 2. *a, b, c.—Diplograpsus pristis* (var. *scalariformis*). Belvoir, Co. Clare.

a, one of the largest examples, with fine axis continued at both extremities; *b*, an intermediate form, having the axis much extended above, both showing the alternating cell divisions; *c*, a small example, without any trace of cell division; all natural size.

Fig. 3. *a, b.—Diplograpsus pristis* (Hisinger, sp.) Belvoir, Co. Clare.

a, largest example, showing fine central axis, and serrated outline of cells; *b*, smaller; do., both natural size.

Fig. 4. *a, b, c.—Diplograpsus mucronatus* (Hall). Belvoir, Co. Clare.

a, largest example, showing long filaments proceeding from the cells, and fine central axis, continued at both extremities; *b*, a bent and distorted specimen; *c*, a small example, showing fine central axis, much extended above.

Fig. 5. *a, b, c.—Graptolithus* (?) *gracilis* (Hall). Belvoir, Co. Clare.

a, a portion of principal axis, giving off several branches, showing cell serratures, natural size; *b*, part of a branch with cells, enlarged 4 diameters; *c*, another specimen, showing the spirally curved central axis, with branches proceeding from it, natural size.

Fig. 6. *a, b.—Graptolithus* (?) *hamatus* (Baily, n. s.) Garrangrena, Co. Tipperary.

a, this small branching Graptolite, natural size; *b*, the same enlarged 3 diameters, showing the hooked character of the cells on the lower portion of its axis.

Fig. 7. *a, b.—Didymograpsus Forchhammeri* (Geinitz). Kilnacreagh, Co. Clare.

a, this diverging Graptolite, natural size; *b*, portion of the same, enlarged 6 diameters, showing the rounded cells, with their orifices.

Fig. 8. *a, b.—Theca cometoides* (Baily, n. s.) Belvoir, Co. Clare.

a, a group of different sized examples, on a slab, with *Diplograpsus pristis*; *b*, one of these Pteropods, enlarged 3 diameters, showing faint indications of annular markings or divisions.